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CLOSING THE BREAK OF THE COLORADO RIVER INTO THE SALTON SINK, SOUTHERN CALIFORNIA.

By H. T. Cory,* Assoc. M. Am. Soc. C. E.

[Within a week of the date on which this article was mailed to us the Colorado River broke through its banks and again poured down into the Salton Sink. The break, as we understand it, was at a new place, and did no harm to the closure works described below.—Ed.]

The closure of the crevasse in the banks of the Colorado River, through which its waters reached the Salton Sink or basin, was a notable and interesting achievement. Had the closure not been affected, the waters in the basin would probably have risen to sea level, thus creating the largest body of water lying wholly within the United States. The elevation of the sea to-day is 208.9 ft. below sea level, and the water covers a surface of 265,000 acres. The sink is a large depression, in Southern California, about one hundred miles west of Yuma, on the main line of the Southern Pacific Co. It has a minimum elevation of about 300 ft. below sea level. From the basin stretches a broad plain, with a nearly uniform slope, having its major axis extending southeast to the Colorado River, a distance of 110 miles, and having an average breadth of 40 miles. The eastern boundary of this plain is the Colorado River, which, like the Nile, the Mississippi, and other rivers heavily charged with silt, flows along a ridge of its own formation, due to the contsant raising of its bed and banks. The sink was originally, no doubt, under the waters of the Gulf of California, and was separated from the Pacific Ocean by some volcanic upheaval. The plain mentioned above drained into the sink and leached out the salts deposited with the soil, while the evaporation of the waters left large salt beds in the lower portion of the depression. It is a popular error that these deposits of salt gave the sink its name, but, in fact, the name is an Indian one and has no significance of that character. During unusually high water, a considerable portion of this plain was irrigated by the river's overflow, but, ordinarily, the overflow covered only the lands immediately contiguous to the banks, so that most of the plain remained absolute desert with no sub-surface water, but with remarkably rich soil—requiring only water to make it one of the most fertile valleys in the world.

In 1896 the California Development Co. was organized for the purpose of diverting part of the water of the river for the irrigation of many thousand acres of land in the Imperial Valley, which lies to the south of the sink. Actual work on the construction of the irrigating system was begun in 1900, and water was first applied to the land in June, 1901. The company took advantage of the opportunity to use one of the overflow drainage channels, known as the Alamo River, from the Colorado's bank westerly for a distance of over fifty miles. The first four miles of this channel [below the present concrete headgate, Fig. 1.—Ed.] parallel the Colorado closely, being but from 800 to 1,500 ft. away, and a dredger was used to deepen it sufficiently to take the water during the low stages of the river. A wooden headgate, 80 ft. in length, was put in at the upper end—just above the boundary line between the United States and Mexico, but, owing to the necessity for getting water at a given time, the floor was placed 5 ft. higher than originally planned, and too high to take water at the river's lowest stage. As a consequence, the canal—which was never made deep enough—silted up, and, although dredgers were kept constantly at work, it was impossible to deliver sufficient water to the settlers, who had made their homes in the valley in much greater numbers than was anticipated. Therefore, in September and October, 1904, a cut was made with a dipper dredge from the first bend of the Alamo River or main canal into the Colorado River itself. This cut was 50 ft. in width and had a grade of 1½ ft. in a distance of 3,300 ft. It promptly silted up, was opened again, and again silted up. A third time it was cut, and, shortly thereafter, a rise in the river widened and deepened it to a dangerous degree.

ATTEMPT NO. 1.—It was then decided to close the opening, at the river bank, and the work of so doing proved technically successful. The method employed (see Fig. 1 for location) was the driving of 10 × 12-in. piling 3 ft. apart and filling between with brush and bags of sand. Unfortunately, the supply of sacks was exhausted, and before more could be secured the improvised dam gave way. It was then realized that more aggressive measures were necessary. However, as there appeared to be no reason for apprehending serious trouble before the annual summer rise of the river, and as the shutting off of the supply of water to the Imperial Valley would have entailed serious hardships on the settlers and given rise to damage claims against the company, the work was allowed to remain in suspense until the directors of Imperial Water Co. No. 1 (the strongest of the subsidiary water companies) offered to undertake the closing of the break and to advance the necessary funds. This offer was accepted by the then chief executive of the California Development Co., and Mr. Thomas Beach, Superintendent of Imperial Water Co. No. 1, with Mr. C. N. Perry, Resident Engineer of the California Development Co., commenced operations on May 25, 1905.

ATTEMPT NO. 2.—The method of procedure was to drive two rows of piling 15 ft. apart, the piles being 15 ft. c. to c. in each row, and then complete the barrier by filling in with brush and sand bags. It was found, however, that, as the piles were driven from one side, the current eroded the opposite bank almost an equal amount, and so, on June 14, 1905, this attempt was abandoned. Sufficient water had passed through the break by that time into the sink to cover up the plant of the New Liverpool Salt Co., at Salton, and to endanger the main line of the Southern Pacific Co. This latter fact had, however, nothing to do with the arrangement made by the Development Co. for a large loan from the railroad company, effected in May, 1905.

On June 6, 1905, Mr. Epes Randolph, by virtue of his wide experience as an engineer and executive, was selected as President and General Manager of the Development Co., while Mr. C. R. Rockwood, the original promoter and chief engineer of the company from its inception until February, 1905, was made assistant general manager and chief engineer. By this time the waters in the sink had risen to such an extent as to necessitate the change in location of the railroad company's tracks in places. Immediately after the waters in the river began to fall, the third attempt at closing the crevasse was begun.

THE COLORADO RIVER AND ITS TROUBLESOME TRIBUTARY, THE GILA.—At this point it is advisable to describe the conditions faced, so far as the flow of the river is concerned. The Colorado rises in the western slopes of the Continental Divide, in Colorado, and is chiefly fed by the snowfall over the mountainous regions of its drainage area. It has a regular spring and summer rise, beginning, ordinarily, May 1 to 15, and continuing until Aug. 1 or Sept. 1—reaching its maximum between June 20 and July 15. Its lowest stage is in January, and the variation in its flow, throughout the year, is enormous—running from 2,600 to 120,000 cu. ft. per sec. Its elevation at Yuma, ninety miles above where it empties into the gulf, is 118 ft. above sea level, at normal low water, while at "The Needles," where it is crossed by the Santa Fe Railroad (three hundred miles above Yuma) its elevation is 600 ft. above sea level. Generally speaking, after leaving the Grand Cañon, a short distance above the Needles, the river flows between low mountain ranges and foot hills, with its floor varying in width from many miles to a few thousand feet. Excepting at low water, it is heavily charged with silt, and, having such a steep grade, it often changes its channel to a remarkable extent. Just above Yuma it is joined by the Gila River—which is formed by the Verde, the Salt and the upper Gila rivers, all of which drain precipitous mountain regions in northern Arizona and the western part of northern New Mexico. Excepting when fed by the melting snows, this river is dry at Yuma, but cloudbursts and heavy rainfalls, extending at times over its entire drainage area, make its flood discharge greater than the maximum of the Colorado alone. These flood rises in the Gila are not confined to any season, but the records since 1878 show that, within that period, sudden rises have occurred every year in each month from Sept. 1 to May 1. In consequence, while normal low water stages in the Colorado, below the mouth of the Gila, are to be expected, sudden floods are always a possibility. Above the Gila's mouth, on the other hand, the flow of the Colorado can be closely forecasted.

ATTEMPT NO. 3.—With these facts in mind, the impossibility of following conservative engineering lines in closing the crevasse is apparent. To close it absolutely predicated serious results to the farmers in the Imperial Valley, as, by this time, the four miles of main canal above the cut had silted up so thoroughly that no water was carried through it at the lowest stage of the river. However, it was decided to close the break and the work was begun on July 14, 1905. A row of piling was driven along the American side of Disaster Island (see Fig. 1) to protect it from erosion and to extend the line on, diagonally, to the western bank (brush being used between the piling to check the flow of the river), the idea being to form sand bars in the Mexican channel, below the diversion piling, thus decreasing the flow in that direction and increasing the flow in the American channel to the Gulf of California. It was found, however, that the soft bottom eroded so rapidly as to undermine the piling when the brush was being placed, and so a second line of piling was started further up stream, with a view to having the sand bars caused by it form along the lower line. The anticipated results were not realized and this method was abandoned in August, 1905. The situation existing at that time may be understood by examining Fig. 1; 65% of the water going down the Mexican side and 35% down the American side of the island to the gulf, the total discharge being 6,600 cu. ft. per second.

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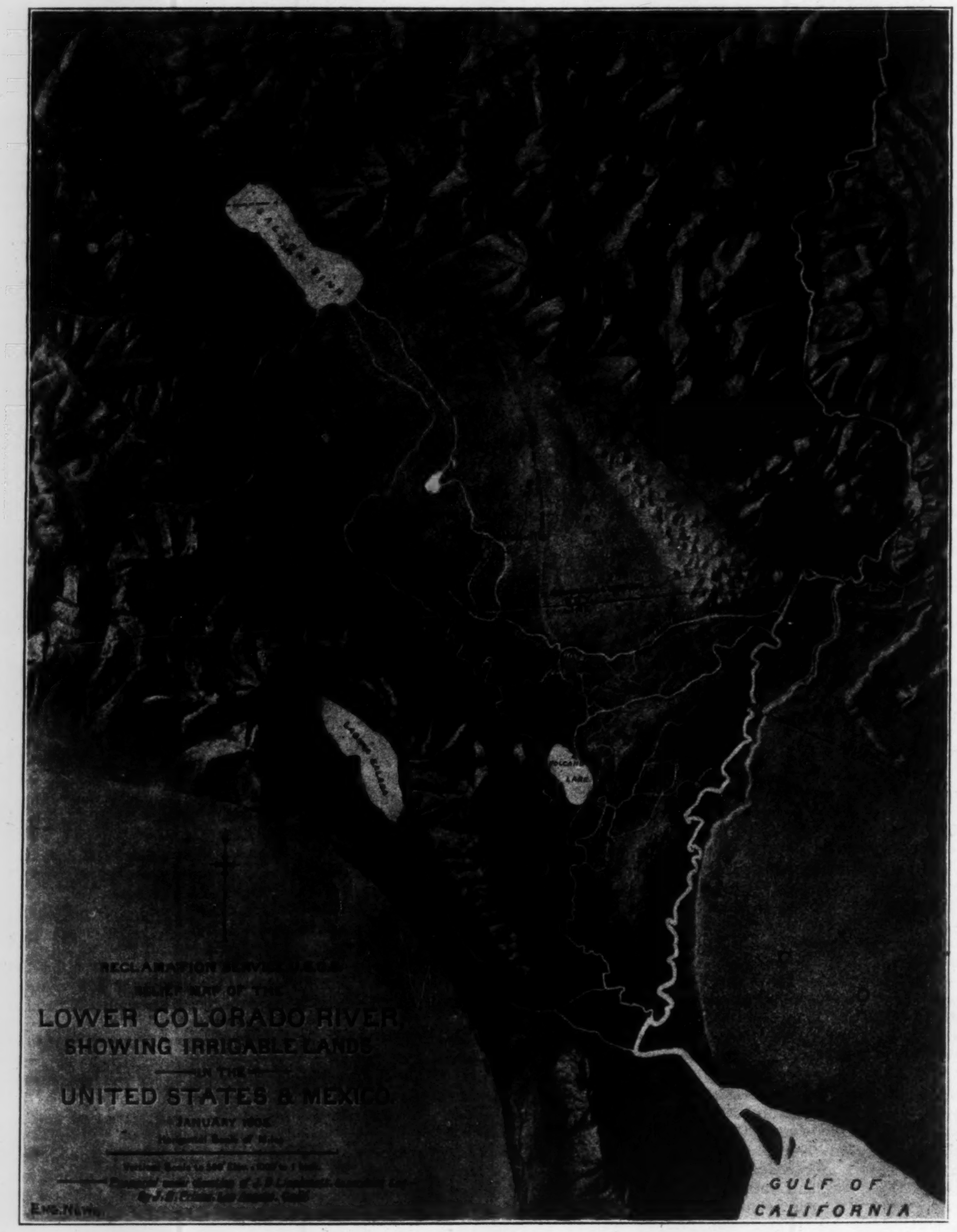
*General Manager and Chief Engineer, California Development Co., Calexico, Cal.



A NEW PROPOSAL.—Mr. Rockwood, assistant general manager, then proposed to deepen the northern channel of the crevasse with a dipper dredge, and build a wooden A-frame gate in the southern channel thereof; then, when the gate should be completed, dam the northern channel opposite it, using the gate to divert the water while so doing. This plan was intended to prevent any shortage of water in the valley and to give a permanent headgate in Mexican territory. A rise in the river occurred just as the work was started and cut away a great deal of the island.

ATTEMPT NO. 4.—Mr. E. S. Edinger, of the Shattuck & Desmond Construction Co., San Francisco, was then retained to build a brush and pile dam in the Mexican channel [illegible]r the up-stream end of the island. This dam [illegible]s 600 ft. long and the plans contemplated a [illegible]ttress foundation. Work was begun on it on [illegible]t. 13, 1905, and progressed so well that there [illegible]as a head of 33 ins. over it when, on Nov. [illegible] 1905, the second largest flood ever recorded [illegible] the Gila River rendered futile this, the fou[illegible] attempt to close the crevasse.

Two days before this disaster a contr[illegible] was signed for a reinforced concrete and ste[illegible]eadgate,* to be built on a rock p[illegible] jutting out of the foot hills just [illegible]h of the International line, to with[illegible] 1,500 ft. of the river bank. This ga[illegible] was designed to carry 10,000 cu. [illegible] per sec., thus enabling all the rive[illegible] be diverted through it and the old [illegible]nal, so permitting the construction [illegible] an earth dam across the crevasse close by the river brink.

ATTEMPT NO. 5.—The amount of work and consequent time required to enlarge the old canal was so great, however, that it was deemed advisable to simultaneously carry out Mr. Rockwood's idea of a wooden headgate on the bank of the crevasse, as it offered a quicker means of controlling the river. On Jan. 8, 1906, actual work commenced, and although it was rushed in every way, unavoidable delays ensued to such an extent that the gate was not completed in time to open the by-pass to and from it and build the dam across the break opposite it before the summer floods, so that operations were brought to a standstill until the flood time had passed. This summer's flood of the Colorado was without precedent, beginning early and reaching a maximum of 96,000 cu. ft. per sec., and persisting to an extraordinary degree as a result of the very heavy snowfall over the drainage area.

The crevasse opposite the wooden gate, which on March 28, 1906, was 500 ft. wide, was 2,600 ft. wide on June 15, and the action of the river indicated conclusively that, when the flood stage had passed, the low water channel would be very near the south bank, and that the wooden headgate would be 1,500 ft. distant, perpendicularly, from the nearest shore.

On April, 20, 1906, Mr. Rockwood resigned as assistant general manager and was appointed consulting engineer, and the writer assumed the duties of general manager and chief engineer.

At this time it was obvious that the work to be done when the summer flood diminished was the building of an earth dam nearly 3,000 ft. long, extending from the wooden headgate across the crevasse—in which the minimum flow of water would probably not be less than 10,000 cu. ft. per sec.; the opening of a by-pass from the crevasse to the wooden headgate and from the latter back to the crevasse, to enable all the water to be diverted through the headgate while building the dam; the raising of sufficient head in the channel of the crevasse to force all of the water through such by-pass and wooden headgate; the building of 5 miles of levee along the river bank, down-stream, from the end of this dam, and 3½ miles up-stream, connecting the wooden headgate with the concrete headgate; the construction of a canal from the river bank to the concrete headgate and from the latter about 600 ft., to connect with the old canal, and the enlarging and deepening of 3½ miles of the old canal between the concrete headgate and the

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[*For a description of this headgate, see article by Mr. J. D. Schuyler, M. Am. Soc. C. E., elsewhere in this issue.—Ed.]

crev in order to prevent disaster to ten thou people in the Imperial Valley.

It med evident, from the conditions of the Colo River drainage area, that the river wou not be low enough to permit operations on dam until the first of August. The available uipment consisted of a small steamboat, sev barges, a floating pile driver, a dipper dre with a 4-yd. bucket, a suction dredge with a 12-in. centrifugal pump, and two drop-hammer pile drivers.

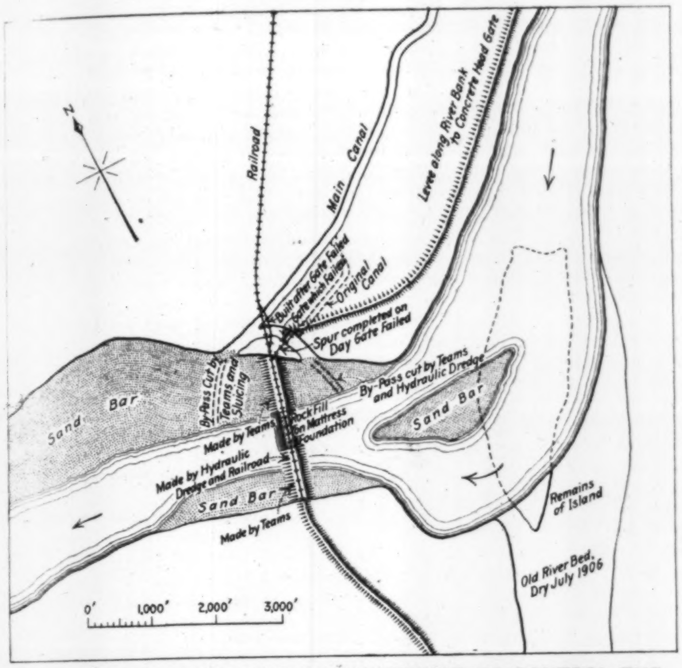
N
Railroad
Main Canal
Levee along River Bank to Concrete Head Gate
Built after Gate Failed
Gate which Failed
Original Canal
Spur completed on Day Gate Failed
By-Pass Cut by Teams and Sluicing
By-Pass cut by Teams and Hydraulic Dredge
Sand Bar
Rock Fill on Mattress Foundation
Made by Teams
Made by Hydraulic Dredge and Railroad
Sand Bar
Sand Bar
Made by Teams
Remains of Island
Old River Bed, Dry July 1906
0'
1,000'
2,000'
3,000'

FIG. 2. ILLUSTRATING THE SIXTH ATTEMPT TO CONTROL THE BREAK OF THE COLORADO RIVER INTO THE SALTON SINK.

The weather in this locality during the summer is extremely hot and the supply of labor throughout the entire Southwest was limited. Under such conditions it was evident that the efficiency of the men and teams would be low; in fact, until about two years ago no work with horses was considered possible in that region during the hot season. The material to be moved with teams—in the dam alone—was 300,000 cu. yds., and that in the levees, 400,000 in addition. The major portion of the latter could be deferred somewhat, but it was necessary to do all of the team work in the dam before any of the water could be shut off from entering the Salton Sink.

A very comfortable camp, with screened bunk houses and tents, was hurried to completion at the dam site, and aggressive measures taken to gather a large force of men. The labor situation made this very difficult, and it was necessary to draw upon a supply of Indian labor throughout a region of two hundred miles. To handle material and supplies, it was necessary to build a spur track from the main line of the Southern Pacific at a point ten miles west of Yuma. This spur track was 6½ miles in length, or a total of eleven miles, including sidings and quarry and clay-pit spurs. A quarry was developed on the north side of the spur of rock on which the concrete headgate was founded, and a gravel pit on the south side of the same spur. On another spit lying close by was found a peculiar quality of clay, composed of very fine particles of semi-cementing material. A mixture of the gravel and clay, in equal parts, made an ideal material for an earth dam. Because of the fortunate occurrence of these necessary materials, it was possible to make the operations self-contained. A steam shovel was put in the rock quarry, another in the gravel pit, and a third in the clay pit, while seventy 50-yd. steel, side-dump ballast cars, with four locomotives, water cars, cabooses, and other equipment, and necessary crews, were secured from the Southern Pacific Co. Work was also rushed in digging the by-pass from the wooden headgate to the banks of the crevasse by means of horses, a dipper dredge and a suction dredge. At the same time all preparations were completed for the weaving of mattresses. A large force of scraper teams was put to work throwing up as much of the bed of the crevasse as was left exposed by the receding water.

On August 10, 1906, the discharge of the river was still 24,000 cu. ft. per sec., and the extraordinary volume of water which had reached the Salton Sink had raised its surface to a height which, ordinarily, would not have been attained in less than three years. The average annual discharge of the Colorado River is 8,000,000 acre-feet, but more than that quantity had passed Yuma between May 1 and July 15. As the water in the Salton Sink rose, the Southern Pacific Co. had moved back its tracks from time to time, and the last move had been to a location which closely followed the contour at an elevation of 200 ft. below sea level, for a distance of 40 miles. On August 10, the water was but a few feet lower than the base of the ties for over four miles at one end and six miles at the other. This critical situation necessitated rushing the work of closing the crevasse to the outside limit of safety. At this time the dipper dredge was at work deepening the old main canal (see Fig. 1) and cutting the connecting link between it and the concrete headgate; a large force of teams was digging a canal from the concrete headgate to the river and to a bottom elevation of 108, at which depth the water table was reached; the suction dredge had just completed its work of opening the entrance to the wooden gate from the crevasse, leaving it with an average width of 80 ft. and a maximum depth of 7 ft. below the surface of the water in the river; the lower portion of the by-pass from the wooden gate had been completed to a similar width through that portion of its length lying in original soil, and to a width of 5 ft. down to the water table through the exposed sand bar in the bed of the crevasse; the earthwork of the dam proper over the exposed portions of the bed had been brought to Elev. 116; and the railroad track had been carried over the canal and by-pass at the dam site and over the completed earthworks of the dam itself to the water's edge on the north side. On the south side, a brush jetty had been thrown up to within 600 ft. of the northern bank, and the suction dredge had started filling in from the south bulkhead toward the south bank.

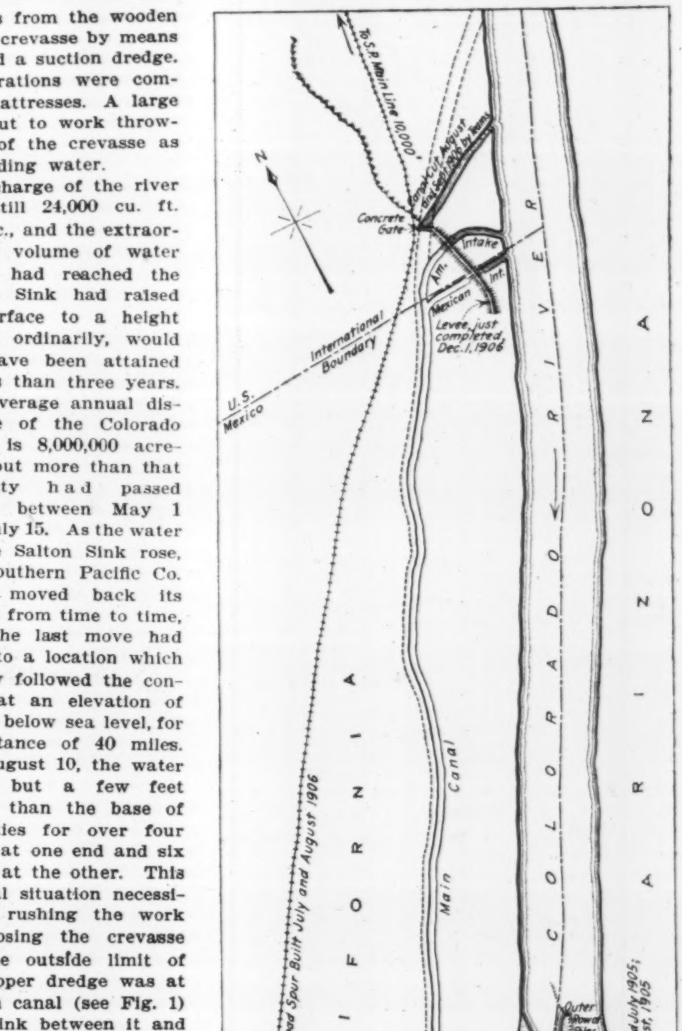
To S.P. Main Line 10,000'
N
Canal Cut August and Sept. 1906 by Teams
Concrete Gate
Intake
Am.
Int.
Mexican
Levee, just completed, Dec. 1, 1906
International Boundary
U.S.
Mexico
RIVER
COLORADO
ARIZONA
CALIFORNIA
Railroad Spur Built July and August 1906
Main Canal
Outer Row of Piles
3rd Attempt commenced July 1905; abandoned August, 1905
Sand Bar
Sand Bar
Brush Diversion Jetty
4th Attempt commenced Oct. 13th 05 washed away by the Flood Nov. 29, 1905
Nov. 28, 1905
Mat Diversion Dam
Shore after Flood, Dec. 5, '05
Dry below
5th Attempt to close Intake Diversion Gate commenced Jan. 8, '06; washed out Oct. 11, '06
1st Attempt to close Intake, Jan. 1905
Main Canal before the 1904 Floods
Sand Bar
LOWER MEXICAN INTAKE
Dam
Original Lower Intake Cut in Sept., Oct., 1904
South Shore, Jan. '06
Shore, May
Dry below
2nd Attempt commenced May 1905; abandoned June 14, 1905
Levee
ISLAND
EAST CHANNEL
LOWER
0'
1,000'
2,000'
3,000'
ENG. NEWS.

FIG. 1. MAP SHOWING LOCATION AND GENERAL CHARACTER OF THE FIRST FIVE ATTEMPTS TO STOP THE FLOW OF THE COLORADO RIVER INTO THE SALTON SINK.

The bottom of the river was then mattressed the entire width of the remaining channel (600 ft.) in the following manner: A line of piles 180 ft. above the center line of the dam was driven with 40-ft. centers. A barge 120 ft. long and 30 ft. wide, fitted with skids for the weaving of the mat, was anchored to the piles. The mattress was made of brush fascines, 18 in. in diameter and 100 ft. long, woven together on main cables of ½-in. wire strand, running at right angles to the current and spaced 8 ft. apart. The fascines were held together and to the foundation cables by continuous sewing with 5-16-in. galvanized iron, flexible, wire cable, attachments being made to the main cables by cable clips every six ft. Anchor cables to hold the mat against the current were attached to the piling at 20-ft. intervals across the stream. The mattress was woven continuously from the ends towards the center, the fascines being parallel with the current. When the woven mat filled the skids the barge was pulled out from under it, allowing that much of the mattress to sink. The swift current scoured out underneath the barge at the up-stream end, and formed a bar under the lower edge, and the upper edge of the mattress being held down by the anchor cable caused the upper end of the mattress to be held normally deeper than the lower end. Almost immediately upon being submerged the mattress silted up and sank to the bottom and was covered over with fine sand. In the deeper portion of the channel, two mattresses were woven. The rate of weaving the mattresses was 80 ft. in eleven hours.

Bulkheads of piling and brush were placed at both ends of the mattress and a railroad trestle thrown over the center line of the mattress along the center line of the dam, consisting of four pile bents placed at 10-ft. centers, the average length of the piles being 40 ft., and the minimum penetration 15 ft. The piling was cut off at Elev. 114, this figure being determined upon because the cross sections in the old channel showed that at Elev. 113 the water was sufficient for the discharge of 10,000 cu. ft. per sec., and it was desirable to have the trestle as low as safety would permit.

A temporary trestle was also extended from the south bulkhead 600 ft. over that portion of the dam which had been filled in by a suction dredge, and the track thus made complete over the entire length of the dam.

This done, rock and gravel were dumped until a difference of water elevation above and below the trestle of 5.8 ft. was obtained, at which point the by-pass leading to and from the wooden gate had sluiced out and the entire discharge of the river was passing through the gate itself.

At this stage of the work, a considerable rise in the river occurred, bringing down quite a quantity of drift, choking the gate and inducing a scour above and below it. To protect the former, which was much the most threatening, a spur track (see Fig. 2) was rushed from the main dam across the by-pass above the gate, the center line being 30 ft. above the upper edge of the gate floor. This was done for two reasons: (1) To permit dumping rock in front of the gate to protect against the scour; (2) to fill in the gate itself with rock, as by that time it was evident the drift would render it out of the question to use the flash boards. Just as this spur was completed, on October 11, at 3:30 p. m., without any warning, the gate suddenly failed entirely, 120 ft. of it rising suddenly and floating down-stream about 150 ft., where it lodged. Thus ended the fifth attempt at closing the crevasse.

ATTEMPT NO. 6, WITH CLOSURE.*—When the gate failed, the water which had been impounded above the dam and the gate was drawn off very rapidly, and all of the water in the river (12,000 cu. ft. per sec.) was going through the width of 120 ft., or the length of that portion of the gate which had been carried away. The channel of the crevasse now made an abrupt curve into the by-pass and the banks of sand began melting away at that point like so much sugar. The sudden rush of water weakened the trestle which had been above the gate and it settled down stream, badly out of line. The debris from the gate lodged against the railroad trestle just below the gate, taking away two bents entirely and destroying the usefulness of five more. One hundred and twenty feet of the old gate was lodged but one hundred feet above this trestle, and it seemed very probable that it would be dislodged and complete the ruin of the railroad trestle at any moment. The north bulkhead of the gate was being weakened constantly, and 80 ft. of the gate which remained in place was settling at its outer end, slowly but constantly.

Mr. Randolph hurried to the scene, and, after a brief conference, decided upon the following course of action, which, beset with difficulties and uncertainties as it was, impressed itself as the only one to follow in order to accomplish the closure of the break at this low water stage and so avoid the great damage and distress that would inevitably have resulted had the work of effecting the closure been delayed until low water season of next year. The throwing of three rock-fill or cascade dams, one above the other, across the by-pass, forcing all of the water across the dam again; then building a rock-fill dam to produce a head of 16 ft. in a stream carrying 12,000 cu. ft. per sec., the total possible length of such dam being 390 ft. Accordingly the two existing trestles across the by-pass were repaired and a third one put in above the lower or main line trestle, and rock ordered from every quarry within a distance of 400 miles.

It must be understood that the whole region, for hundreds of miles in every direction, is practically a desert and that quarries are infrequent. It was therefore necessary to tax to the utmost a quarry at Patagonia, 16 miles north of Nogales, Ariz., and 35 miles east of Yuma; to reopen one at Tacna, 40 miles east of Yuma; another at Ogilby, 15 miles west of Yuma, and to draw from the Declez quarry, on the Southern Pacific main line (from which rock is furnished for the San Pedro breakwater), and from the Bly quarry on the Salt Lake Railroad, both near Colton, Cal., and from the Casa Blanca quarry on the Santa Fe Road, near Riverside, Cal. In addition, the entire output of the Mammoth gravel pit, 50 miles west of Yuma, was taken. Every available flat car on the Los Angeles and Tuscon divisions of the Southern Pacific Co., with 135 side dump steel cars, were put in service. In a few days, 150 to 200 carloads of rock were being rushed in and unloaded daily. All of the rock loaded on flat cars was pinched off with bars, there being no time to arrange any other method of handling. Rock of more than six tons was broken into smaller pieces by use of dynamite while on the cars. By these methods, it was just 21 days from the time the first car of rock was unloaded from the lowest trestle over the by-pass until every drop of water (Nov. 24, 1906) was being forced down the old channel of the Colorado River, and the crevasse technically closed.

The order of procedure was to raise a head of 3 ft. at the lowest trestle across the by-pass, then a head of 3 ft. in the middle trestle, raising the head over the upper trestle a corresponding amount. This was sufficient to stop all water going through the by-pass and where the gate had stood, and cause all of the water to go over the dam. While this was being done, a second trestle was hurried over the main channel, 30 ft. above the one forming the dam proper, and rock was unloaded from the main trestle of the dam until a head of 13 ft. was attained; then efforts were confined to the auxiliary trestle, where an additional head of 2 ft. was obtained, when the water surface above the elevation of the dam reached 113.1 and the entire flow of the river was diverted to its old channel. The elevation of the water opposite the concrete gate, which was 108.2 when the work began, was increased as the crevasse was closed, until it attained a height of 113.7, which permitted 350 sec.-ft. to pass through the concrete headgate and on down to supply the needs of the Imperial Valley. The additional work of deepening the old canal was immediately started, consisting of dynamiting the bottom, and, although the surface of the water opposite the concrete headgate has very slowly but steadily fallen, the quantity of water passing through the canal has constantly increased until there seems to be no further danger of a shortage in the valley.

Such, in a general way, are the principal facts connected with the closing of the Colorado River crevasse—a work which, on account of peculiar conditions and difficulties involved, ranks without parallel in work of this character, so far as the knowledge of the writer runs.

STATISTICAL SUMMARY.—The efforts of the Development Co. having been confined almost exclusively to the actual work of making the closure, it is not yet possible to give details of cost, but the following approximate data of the work done since July 1, 1905, may prove of interest: The completed earth dam across the break will be 31 ft. wide on top and have side slopes of 3 to 1. The maximum height will be 42 ft., and its top elevation 124 ft. above sea level. The main line of the Inter-California Railroad will lie on its top, and a siding will extend its entire length, making a double track over it. The 8½ miles of levee will have a top width of 12 ft., side slopes of 2½ to 1 on the river side, and 2 to 1 on the land side, and will be composed of sand and loam, blanketed on the top and sides with 1½ ft. of cementing gravel, and have a railroad track along the top for the entire length. The Rockwood, or wooden gate, was 200 ft. between bulkheads; had a 60-ft. floor up-stream and down-stream; was founded upon 500 anchor piles, and had three lines of sheet piling, one extending lengthwise along the up-stream edge of the floor, one along the down-stream edge, and one midway between the other two. It was an A-frame flashboard gate, the top of the A-frame being 25 ft. above the floor of the gate. There were 39 such A-frames, leaving 40 openings each 4 ft. 2 ins. wide in the clear.

The reinforced concrete gate is of the Taintor, or radial arm type, with eleven openings, each 10 ft. high and 12 ft. long, and having a navigation pass at one end 10 ft. 8 ins. in width. [12 ft. wide, according to Mr. Schuyler's article, following.—Ed.]

There were 2,200 cords of brush and 40 miles of steel cable used in the construction and shore protection; 3,800 lin. ft. of railway trestle was constructed, and 1,100 piles driven; 70,000 tons of rock, 40,000 cu. yds. of gravel, and 40,000 cu. yds. of clay were put in place by trains, 85 per cent of the rock being put in place in 21 days; 100,000 sacks of sand were required in the dam and in endeavors to protect the gate; 300,000 cu. yds. of earth were placed by teams, and 200,000 cu. yds. handled by dredges.

The maximum number of men working under the direction of the California Development Co. between the junction of the spur track with the main line of the Southern Pacific Railroad and the dam site and levees, was 1,100, of whom 350 were Indians. In addition to this, from Oct. 15 to Nov. 4, an army of men was working in various quarries and in the railroad service handling rock exclusively for this work, while 600 head of horses were employed during practically the whole period from July 1 to early December.

Colonel Vega, Governor of the territory of Lower California, put all of the land lying in Mexican territory within a radius of six miles of the dam site under martial law, and the sale of intoxicating liquor, gambling, etc., was strictly prohibited. The Primero Commandte de Gendarmeria of the Territory, Sr. Villarino, was placed in charge with a small corps of his Rurales. In the United States all the operations near the heading were in San Diego Co., in which county it is against the law to sell intoxicating liquors. As a consequence, there was absolutely no disorder during the progress of the work.

Mr. James D. Schuyler, M. Am. Soc. C. E., designed the concrete gate, and Mr. Carl Leonhardt, of Los Angeles, had the contract for its construction. Mr. C. R. Lockwood built the wooden headgate according to his own designs, with a staff of employees of the California Development Co., Mr. W. J. Best being superintendent during its construction. Mr. Thomas J. Hind was superintendent of construction at the crevasse after June 1, 1906, and Mr. E. Carrillo was superintendent of the construction of the railroad spur and of developing the quarry, gravel and clay pits, and of the steam shovels therein employed. Mr. C. E. Dagenette, Indian Outing Agent, and Dr. A. L. Leeds, Indian Agent, provided the Indian labor employed.

[*As we stated on the first page of this article, this closure did not prove to be permanent.]

THE REINFORCED CONCRETE AND STEEL HEADGATES FOR THE IMPERIAL CANAL, COLORADO RIVER.

By James D. Schuyler*, M. Am. Soc. C. E.

Now that the great crevasse in the banks of the Colorado River has at last been successfully closed through the almost superhuman efforts and lavish expenditure of the Southern Pacific Co. and the Salton Sea is no longer to become a source of anxiety and menace, public interest centers upon the development of the Imperial Valley by irrigation of its vast area of fertile lands. This territory is destined within a few years to become the most valuable and productive portion of the agricultural back country tributary to Los Angeles, and its development into an empire teeming with population is destined to become a powerful factor in the upbuilding of this city. The tremendous scouring action of the great river which has been plowing its way through the channel of the Imperial Canal has solved all the questions of the past as to the carrying capacity of that canal and its ability to deliver water to the valley.

Since the closure of the break four miles below the permanent headgates of concrete and steel, located on solid bedrock near the International boundary, all the water reaching Imperial Valley has been forced to pass through these headgates, and follow down the original canal channel. This channel had become considerably silted for the upper four miles prior to the break, but for some months past a dredger has been at work deepening it, so that at last accounts a volume of 1,700 cu. ft. per sec. was passing down the canal to the valley, all to be used in irrigation alone. It is reported that this flow is rapidly cutting back up the canal toward the headgates, so that the work of enlargement begun by the dredger is being continued by the water, and in due course this section of the canal will have as much capacity as may be needed for all future time, and with its increased grade will never again become choked with silt.

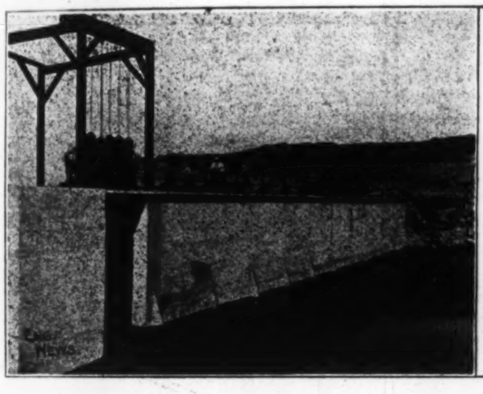

Fig. 1. From Above; Water Standing 10 Ft. Deep.

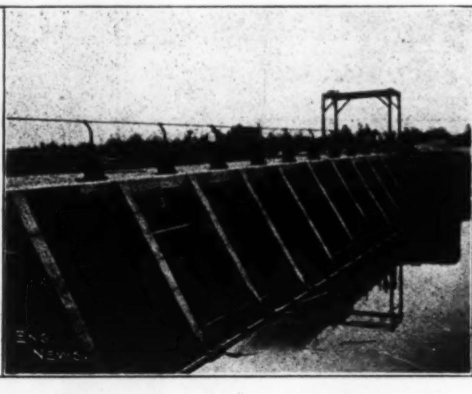

Fig. 2. From Below; Radial Gates, with Reinforced Concrete Facings.

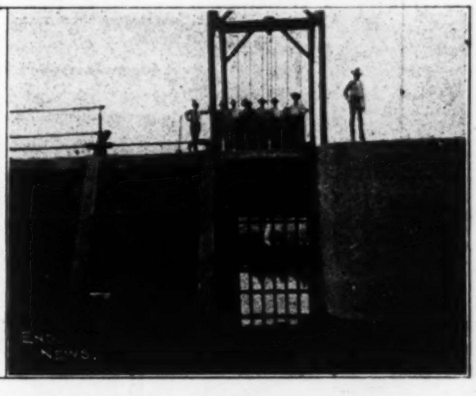

Fig. 3. Navigation Pass, from Above; Also Showing Radial Gates.

VIEWS OF REINFORCED CONCRETE AND TAINTOR STEEL RADIAL HEADGATES. IMPERIAL VALLEY CANAL, COLORADO RIVER, SOUTHERN CALIFORNIA.

But little has been said about the canal headgates and the public does not generally realize that this great structure is without doubt the largest and most capacious, as it is one of the most substantial, modern and scientific of all the irrigation canal headgates in America. Its equal can only be found by a comparison with the great irrigation canals of India or Egypt.

The headgate (see views) was designed by the writer, the drafting having been done by Mr. Geo. S. Binckley, of San Francisco, now chief engineer of the water-works and sewer systems of Monterey, Mex., under Mr. Schuyler's immediate supervision. The actual construction of the gate was placed in charge of Mr. James W. Martin, Inspecting Engineer, under Mr. C. R. Rockwood, Chief Engineer, and the writer as consulting engineer. The contractor for the work of excavation and the building of the concrete, and erection of the gates, was Mr. Carl Leonardt, of Los Angeles. The steel frames of the gates and the hoisting devices were manufactured in Los Angeles by the Llewellyn Iron Works, under the supervision of Mr. J. E. Brett, Mechanical Engineer.

Excavation was begun Dec. 15, 1905, and the entire job completed June 28, 1906. The floor of the gates is at Elev. 96 ft. above sea level, about 5 ft. below the bed of the river, and 10 to 11 ft. below low water level. Their capacity is estimated at 10,000 cu. ft. per sec.; sufficient water to irrigate the 500,000 acres of available land in the United States under the system, and an equal area in Mexican territory. It will be capable of carrying all the low water flow of the river whenever the canals are prepared to receive the water.

The gate is founded on solid granite bedrock on the most easterly spur of Pilot Knob mountain, the last point of rock before reaching the gulf, and situated about 800 ft. north of the International Boundary. The gate structure consists of 11 culverts, each 12 ft. wide and 10 ft. high in clear opening, in addition to a 12-ft. "navigation-pass" for small boats. These culverts are separated by piers of reinforced concrete, 18 ins. thick, and are surmounted by a massive cellular structure of reinforced concrete loaded with 1,650 tons of gravel, and extending to a height of 26 ft. above the sub-floor, placing the top of the structure well above maximum floods.

Each of the culverts is closed with a steel frame gate in the form of a segment of a circle, hung on a heavy shaft of solid steel, and hoisted by two cables of phosphor-bronze. Each gate is raised independently by turning on its shaft, and may be lifted by hand or by a gasoline engine, which is attached to one end of a shaft, running the entire length of the structure, to which any gate may be thrown in or out of gear, for hoisting or for lowering. Two men can easily lift or lower a gate, as they are so balanced as to be unaffected by water-pressure, whatever the height of the river. In other words, the pressure of the water adds nothing to the resistance to the lifting or closing of the gate. It is the first gate of its class ever built in California, and although similar gates are successfully used in Idaho, Colorado and other parts of the Northwest they have not been introduced on this coast heretofore, and there are none in use operating under conditions of as great pressure in flood as these. The faces of the gate are of reinforced concrete, and each weighs about 10 tons, although the actual load to be lifted by the hoisting device does not exceed 4 tons.

The entire cost of these great gates was $44,400, of which $26,770 was the cost of the gate structure, and $14,812 the cost of the steel work, erection, hoisting devices, etc., the remainder being for incidentals and engineering. Earth excavation amounted to 12,637 cu. yds.; rock excavation, 5,700 cu. yds.; concrete, 1,205 cu. yds.; gravel ballast, 1,100 cu. yds.; steel in gates, reinforcing bars, etc., 250,300 lbs.

For simplicity of operation and massiveness of construction these great gates are worthy of inspection by all who are interested in works of such magnitude, and they are certain to become noted as a model of their class. As the new railway line of the Southern Pacific from Yuma to Calexico and Imperial through Lower California passes within 100 ft. of these headworks, they will be easily visited in the future when this line shall have been completed and put in operation.

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*Consulting Engineer, Los Angeles, Cal.

[Written just before the fresh break of Dec. 10, 1906.—Ed.]

PRESIDENT ROOSEVELT, AND PRESIDENT HARRIMAN OF THE SOUTHERN PACIFIC CO., ON CLOSING THE COLORADO RIVER BREAK.

Telegrams relating to another attempt to close the break of the Colorado River into the Salton Basin passed between President Roosevelt and Mr. E. H. Harriman, President of the Southern Pacific Co., on Dec. 19 and 20. Mr. Harriman, it appears, suggested or requested that the closing of the new break be taken in hand by the engineers of the U. S. Reclamation Service. The resulting telegrams, on Dec. 20, are as follows:

The White House,
Washington, D. C., Dec. 20, 1906.

Mr. E. H. Harriman, 120 Broadway, New York:

Replying to yours, 19th, Reclamation Service cannot enter upon work without authority of Congress and suitable convention with Mexico. Congress adjounrs to-day for holidays; impossible to secure action at present. It is incumbent upon you to close break again. Question of future permanent maintenance can then be taken up. Reclamation Service engineers available for consultation. This is all the aid that there is in the power of the Government to render, and it seems to me clear that it is the imperative duty of the California Development Co. to close this break at once. The dangers ultimately due only to the action of that company in the past in making heading completed in October, 1904, in Mexican territory. The present crisis can at this moment only be met by the action of the company which is ultimately responsible for it, and that action should be taken without an hour's delay. Through the Department of State I am endeavoring to secure such action by the Mexican Government as will enable Congress in its turn to act. But at present Congress can do nothing without such action by the Mexican Government.

This is a matter of such vital importance that I wish to repeat that there is not the slightest excuse for the California Development Company waiting an hour for the action of the Government. It is their duty to meet the present danger immediately, and then this Government will take up with them as it has already taken up with Mexico the question of providing in permanent shape against the recurrence of the danger.

Theodore Roosevelt.

MR. HARRIMAN'S REPLY.

Replying to your telegram this date, you seem to be under the impression that the California Development Co. is a Southern Pacific enterprise. This is erroneous. It had nothing to do with its work or the opening of the canal. We are not interested in its stock and in no way control it. We have lent it some money to assist in dealing with the situation. What the Southern Pacific Co. has done was for the protection of the settlers as well as of its tracks, but we have determined to move the tracks on to higher ground any way. However, in view of your message I am giving authority to the Southern Pacific officers in the West to proceed at once with efforts to repair the break, trusting that the Government, as soon as you can procure the necessary Congressional legislation, will assist us with the burden.

E. H. Harriman.

THE PRESIDENT TO MR. HARRIMAN.

Am delighted to receive your telegram. Have at once directed the Reclamation Service to get into touch with you so that as soon as Congress reassembles I can recommend legislation which will provide against a repetition of the disaster and make provision for the equitable distribution of the burden.

Theodore Roosevelt.

Press dispatches from the West state that repair work was started on Dec. 20; also that three trestles will be built across the break and rock dumped from them to effect a closure.

* * *

A FIREPROOF FERRY-BOAT.*

By F. L. DuBosque,† M. Soc. N. A. & M. E.

The study that has been given to the fireproof construction of permanent structures has developed buildings that may be truly considered fireproof, and this result has been brought about by the invention and combination of materials of fire-resisting qualities.

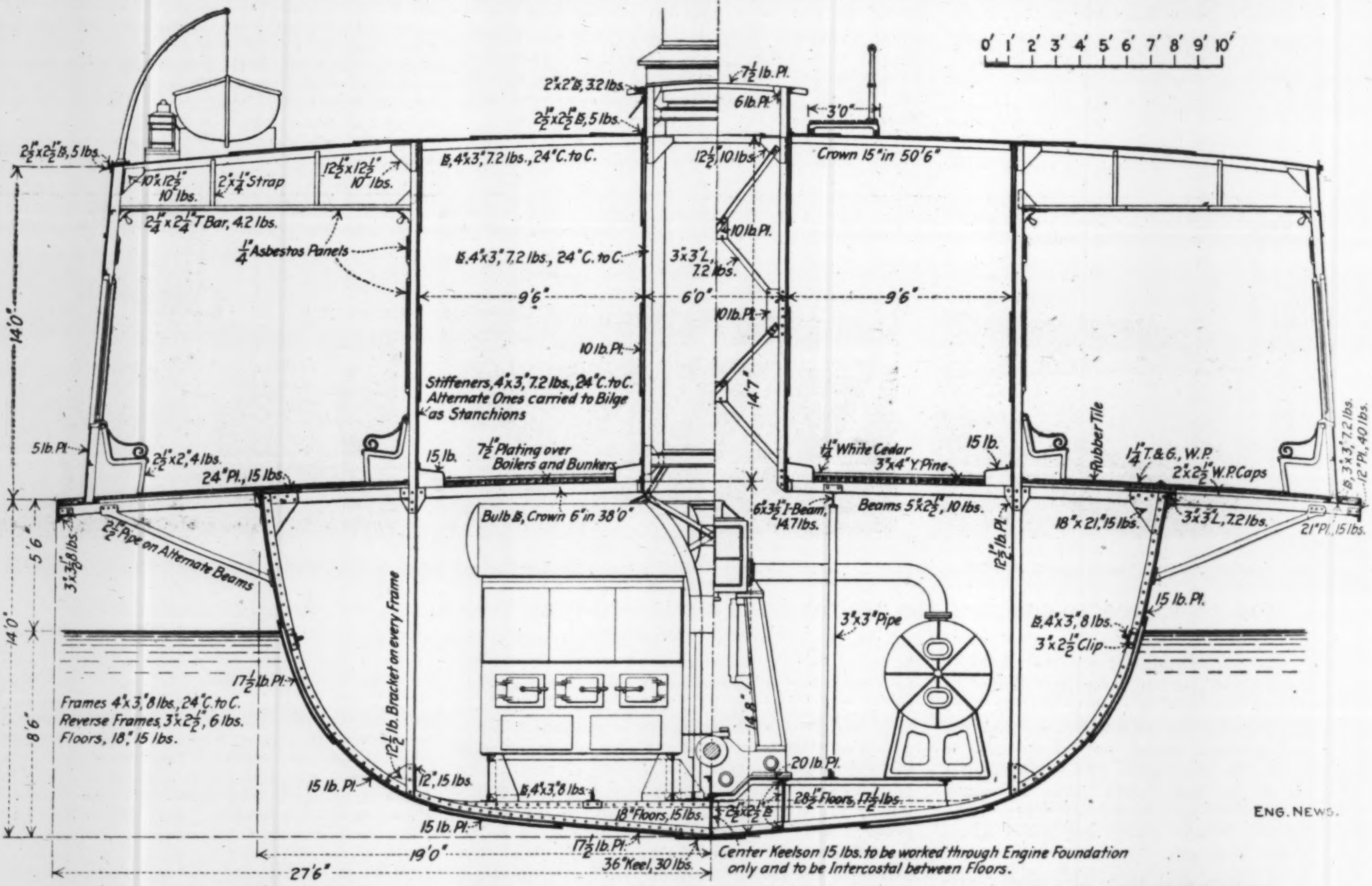
2½"x2½" B, 5 lbs.
10"x12½" 10 lbs.
2"x¼" Strap
12½"x12½" 10 lbs.
2¼"x2¼" T Bar, 4.2 lbs.
¼" Asbestos Panels
14'0"
5 lb. Pl.
2½"x2", 4 lbs.
24" Pl., 15 lbs.
B, 4"x3", 7.2 lbs., 24" C. to C.
B. 4"x3", 7.2 lbs., 24" C. to C.
9'6"
10 lb. Pl.
Stiffeners, 4"x3", 7.2 lbs., 24" C. to C. Alternate Ones carried to Bilge as Stanchions
15 lb.
7½" Plating over Boilers and Bunkers
2"x2" B, 3.2 lbs.
2½"x2½" B, 5 lbs.
7½ lb. Pl.
6 lb. Pl.
3'0"
12½", 10 lbs.
10 lb. Pl.
3"x3" L, 7.2 lbs.
6'0"
10 lb. Pl.
14'7"
Crown 15" in 50'6"
9'6"
1¼" White Cedar
3"x4" Y. Pine
15 lb.
Rubber Tile
1¼" T. & G., W. P.
2"x2½" W. P. Caps
B, 3"x3", 7.2 lbs.
12" Pl., 40 lbs.
0' 1' 2' 3' 4' 5' 6' 7' 8' 9' 10'
5'6"
3"x3½" 8 lbs.
2½" Pipe on Alternate Beams
Bulb B, Crown 6" in 38'0"
6"x3½" I-Beam, 14.7 lbs.
Beams 5"x2½", 10 lbs.
12½ lb. Pl.
18"x21", 15 lbs.
3"x3" L, 7.2 lbs.
21" Pl., 15 lbs.
15 lb. Pl.
3"x3" Pipe
B, 4"x3", 8 lbs.
3"x2½" Clip
14'0"
8'6"
17½ lb. Pl.
Frames 4"x3", 8 lbs., 24" C. to C.
Reverse Frames, 3"x2½", 6 lbs.
Floors, 18", 15 lbs.
12½ lb. Bracket on every Frame
14'8"
15 lb. Pl.
12", 15 lbs.
B, 4"x3", 8 lbs.
20 lb. Pl.
18" Floors, 15 lbs.
2½"x2½" B
28½" Floors, 17½ lbs.
15 lb. Pl.
17½ lb. Pl.
36" Keel, 30 lbs.
19'0"
27'6"
Center Keelson 15 lbs. to be worked through Engine Foundation only and to be Intercostal between Floors.
ENG. NEWS.

FIG. 1. A MIDSHIP SECTION OF THE PENNSYLVANIA RAILROAD COMPANY'S FIREPROOF FERRYBOAT "HAMMONTON."

It seems to be the tendency each succeeding year for a greater number of people to congregate within a smaller area, not only in their homes and business places, but on the vehicles they use for transportation. Accidents to vehicles for transportation have resulted in a considerable loss of life by fire from the fact that these vehicles have been constructed of inflammable material, and transportation companies realize the necessity of building their passenger cars of materials that will not burn. The progress in this direction has been very rapid and so successful that it is extremely doubtful if wooden passenger cars will again be constructed for use on any of the larger railroad systems of this country.

The calamity of two summers ago which resulted in the loss of over six hundred lives, impressed upon those engaged in the transportation of passengers by water the necessity of following the progress that has been made in the construction of fireproof buildings, and vehicles for transportation, on land. By some of the transportation companies this feature was appreciated, and an attempt to carry it out has in a measure been followed for the past 15 years. On the ferries of the Pennsylvania Railroad Co. no ferry-boats have been built during this period on which inflammable material was placed close enough to the sources of fire to be in danger of ignition.

Fires on ferry-boats have been frequent, but the consequences usually slight, because of the vigilance exercised by the employees and the means installed for the extinguishment of fire. The principal cause of fire has been the stowage of hot ashes in improperly constructed ash bins or improperly constructed ash pans beneath the boilers. Following in order may be classed imperfect electric wire construction; the accidental overturning of petticoat lamps; the overheating of the smokestack; and the throwing of lighted matches beneath the seats by passengers after lighting cigars, etc. Attempts to eliminate these causes of fire have been made by permitting no woodwork or other inflammable material below the main deck; by running the electric wires in iron conduits with sealed junction boxes; by forbidding the use of petticoat lamps above the main deck; by protecting the stack with an iron enclosure; and by enclosing the space beneath the seats.

Recently another and more serious source of danger arises in the transportation of automobiles. Fire occurring in one of these vehicles on a ferry-boat would be very disastrous, as on most of the ferry-boats the automobiles occupy a space surrounded by the lightest and most inflammable materials that are difficult of access. After automobiles were permitted to use ferry-boats a rule was established that they should be stowed at either end of the boat, so that they could be wheeled overboard in case of accident. The increase in the number of automobiles to be transported, however, makes it impossible to carry all of them on the ends of the boats, and ferry-boats designed in the last two or three years have the walls and roof of the space they occupy made of metal.

But new dangers are continually arising and it is clear that a ferry-boat to be free from danger of destruction by fire should be built of non-inflammable material or be of the fireproof type. Inflammable materials can be used in such a way that there is no possibility of their doing damage. The amount of flame that a piece of wood will produce per unit of time depends first, upon the surface exposed; and second, upon whether the surface is laid vertically or horizontally. It is evident that a stick 12 ins. square contains the same volume but will not produce as much flame as twelve boards 12 ins. wide and 1 in. thick; also that the flames on a surface laid horizontally will not extend as rapidly as if this surface is laid vertically. These features must be borne in mind in the designing of fireproof structures, as up to the present time it seems to have been impossible to eliminate the use of wood.

It has been thought by many that the danger of loss of life on a ferry-boat is very remote, principally because of the boat's short route, and the experience of the past supports this view. Nevertheless, all [illegible] were appalled at the loss of life on the "General Slocum." This boat had better opportunities for securing a landing place for her passengers than has a ferry-boat, yet a combination of circumstances which it is unnecessary here to discuss resulted in the most appalling disaster that has happened to any of our harbor craft. While it may be claimed that such a combination will not happen again, the fact is indisputable that the disaster would not have occurred had the boat been of fireproof construction.

Extending further the ideas they have long had in mind and appreciating the advantages to be gained from a fireproof ferry-boat, the Pennsylvania Railroad Co. prepared the designs of the boat illustrated in this paper and entered into an agreement with the New York Shipbuilding Co., at Camden, N. J., for its construction.

Figs. 1 and 2 show that below the main deck the design departs but very slightly from the prevailing practice, and no woodwork is used in this part of the boat. Above the main deck steel plates and angles have taken the place of wooden stanchions, carlins and sheathing. Realizing that in this particular part of the boat, wood would give sufficient strength with very much less weight than steel, the various sections of plates and angles employed to build up the structure were made as small as thought safe, yet it was estimated that the steel structure will weigh nearly 30 tons more than the wooden structure. This increase, however, is only about 5% of the total displacement of the boat.

As a slight ornamentation of the cabins of a ferry-boat was thought necessary, an attempt was made to carry out this feature. The ceiling and side walls are almost entirely covered with a material known as asbestos building lumber, which is a composition of asbestos and Portland cement that is fireproof, not affected by moisture, has a reasonable degree of tenacity, and can be manufactured in larged-sized panels with a smooth and even surface which receives paint quite as satisfactorily as wood. This material is formed into panels [illegible] fitting steel moldings of suitable design around its edges. These moldings are a recent production and are made by drawing thin strips of steel 0.05-in. thick through [illegible] dies that form the plates into the shape of section desired and of any reasonable length. The angles, grooves and coves are drawn so sharply that when painted the moldings cannot be distinguished from the most perfect wooden molding, and the section is so uniform that joints may be accurately made. The panels thus produced are fastened to the angle-iron stanchions support-walls of the cabin by means of narrow plates thick.

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*A paper read at the fourteenth general meeting of the Society of Naval Architects and Marine Engineers, held in New York, Nov. 22 and 23, 1906.

†Assistant Engineer, Floating Equipment P. R. R., Jersey City, N. J.

It will be noticed from Fig. 3 that the connection between this angle iron and plate is made with pieces of wood which are fastened to the angle bar with bolts, and to which the thin plate is fastened with ordinary round-headed wood screws. It will also be noticed that the frames are fastened to the thin plate which forms the ground of the wall in the same manner, the round heads of the screws being exposed to view. At these points it will be noticed that a limited amount of wood is used, and that it is protected from any external flame by iron plates; the amount of wood used is thought to be insufficient to cause any considerable damage. For instance, a lighted match alongside of an iron plate would burn itself out without doing damage, whereas, a volume of kindlings set afire would cause the plate to bend out of shape; therefore, it is apparent that somewhere between these two extremes a certain amount of wood can be used in fireproof construction without dangerous results. It would have been possible to have made these fastenings with tap bolts, but the great additional expense was thought to be unnecessary.

The seats in the cabin, as shown in Fig. 3 are made of drawn-steel moldings supported on steel angle-bars. The window sash, window sills and frames are made of wood, but the wood used is completely covered with sheet copper of No. 18 gage (see Fig. 3) and the whole is recognized as thoroughly fireproof construction. The pieces of wood forming these parts are first molded in the section desired, then loosely wrapped with copper, and both together are drawn through dies that press the copper firmly down on the wood and lap-joint the edges of the copper sheet. It is this lap-jointing that is the important feature in the operation. Wood covered with metal cannot be considered fireproof if the edges of the material can be twisted away by heating, so as to allow the wooden surfaces to be exposed, and this particular defect has been the cause of destruction of many so-called fireproof buildings.

The main deck of the boat is made of wood. In the cabin it is covered with interlocking rubber tile, which is a fire-resisting material, but no such protection is afforded in the team gangways. Without enormously increasing the weight of the vessel it was impossible to find a substitute for wood which would be entirely satisfactory for this particular place. However, the surfaces of this deck are horizontal, are very easy of access, are constantly in view, and it is therefore thought that a fire occurring on them could not extend very far.

It is estimated that the cost of this boat has been increased about 7% by the construction applied. The interest on this amount is only about 25% more than would pay for fire insurance premiums, and the balance is more than offset by what might be called the cost of fire vigilance.

It is expected that the cost of maintenance of this iron structure will be considerable less than of a wooden one. The greatest enemy of steel is rust, but as the wooden joiner-work on ferry-boats is usually painted about once a year to keep up appearances, it is very evident that the steel structure will be amply protected from rust if painted this often.

Aside from fire protection, the boat is divided into water-tight compartments to prevent her from sinking in the event of a collision, and water-tube boilers have been used to generate steam, for it has been the policy of the Pennsylvania Railroad Co. to use only water-tube boilers on their ferry-boats for the past ten years, as there is probably no one place where a boiler explosion would cause such a loss of life as on a ferry-boat, which on its daily trips frequently carries over 1,000 passengers.

This ferry-boat will be named "Hammonton," will be used between Philadelphia and Camden, and its construction is now practically finished. In conclusion it is appropriate to state that considerable credit is due the New York Shipbuilding Co. for the enthusiasm with which they have entered into the details of construction, which appeared at the start to be very complicated and to which they have given a considerable amount of time and study.

Dimensions of Ferry-Boat "Hammonton."

Length, over all	168 ft.	0 ins.
Length, outside to outside body post	167 "	0 "
Length, outside to outside propeller post	138 "	0 "
Beam, over guards	55 "	0 "
Beam, of hull molded	38 "	0 "
Depth, from top of keel to top of deck beams, amidships	14 "	8 "
Camber fore and aft	1 "	0 "
Draft	8 ft. 6 ins.	
Displacement	625 tons.	
Boilers—Two of Babcock & Wilcox type.		
Heating surface, combined	3,300 sq. ft.	
Grate surface, combined	93 sq. ft.	
Engine—Three-cylinder compound:		
High-pressure cylinder	18 ins.	
Low-pressure cylinder	28 "	
Stroke	22 "	
Indicated horse-power	600	
Propeller, diameter, 8 ft. 3 ins; pitch.	12 ft. 6 ins.	
Number of electric lights	225	
Number of seats	272	
Surface condenser, cooling surface	1,700 sq. ft.	

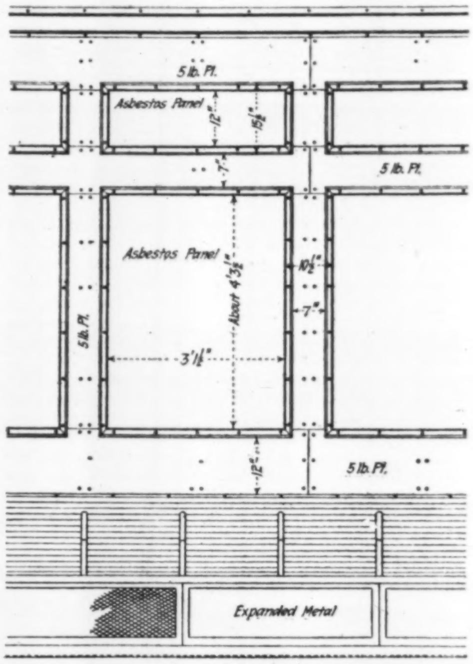
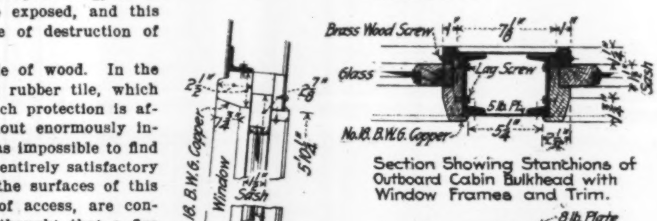


Fig. 3. Elevation of Inboard Bulkhead of the "Hammonton."



Section Showing Stanchions of Outboard Cabin Bulkhead with Window Frames and Trim.

Section Showing Stanchions of Inboard Cabin Bulkhead and Method of Connecting the Panels.

FIG. 2. DETAILS OF FIREPROOF CONSTRUCTION USED IN THE "HAMMONTON."

A CONCRETE PILE FOUNDATION.

In our issue of July 26, 1906, we described a new method of manufacturing concrete-steel piles invented by Mr. A. C. Chenoweth, of Brooklyn, N. Y. Since that time the Erie Railroad has used the pile in the foundation walls of a new concrete power-house at Susquehanna, Pa. Owing to the presence of a furnace slag pile on top of old river silt, it was necessary to drive piles, and on account of the semi-liquid state of the material wooden piles were deemed unsafe.

The piles were made on the premises by two Chenoweth machines, piles being reinforced by steel wire mesh and eight ½-in. square steel bars placed near the circumference of the piles equally distant apart. The wire mesh with a 1:2:3 concrete were wound in convolution about a 2-in. iron tube which formed the center of the pile. The outside was wound every 4 ins. with steel No. 10 gage wire passed around the pile five times and fastened. After being flushed with cement mortar, the piles were allowed to rest 20 days before driving. Seventy-eight of these piles, 14 ins. in diameter, were driven through 21 ft. of clay filling furnace slag and river silt to rock.

Mr. Chenoweth's method for protecting the head of the pile from jar and transmitting the blow was by use of a driving cap consisting of a cylinder of steel in which was placed a diaphragm of steel; below this diaphragm a cushion of rope was placed over the top of the pile, then a wooden block above the cushion; above the diaphragm sand was placed; on the sand a false wooden pile projected above the cylinder of steel, which received the blows from the hammer. The claim that this is a perfect protection of a concrete pile was well borne out by the Susquehanna work. No fracture appeared, although very heavy blows were delivered by a 3,000-lb. hammer.

◆

A FIRE IN THE 14-STORY BUILDING of the New York Life Co., at La Salle and Monroe Sts., Chicago, on Dec. 18, illustrated some of the risks of such buildings. The fire started at the basement in a shaft for pipes and electric wires, but was only discovered when it had reached the ninth floor. An alarm was turned in by the night engineman, but the fire soon reached the top of the building and began to spread through the three upper floors. The janitors got out the hose, attached the standpipe in the building, but the fire pumps of the building apparently refused to work and connections had to be made with the fire engines. The damage amounted to about $15,000.

◆

THE FIRE UNDERWRITERS' RULES have undergone a number of changes since 1905, as noted in the supplements recently issued. The supplement to the National Electrical Code contains the following changes and additions to the edition of 1905. Generators operating at a potential of 550 volts or less must be thoroughly insulated from the ground wherever feasible, and those operating above 550 volts must have their base frames permanently and effectively grounded. Motors operating under these respective conditions must be treated in the same way, and when operating in excess of 550 volts must have no live metal parts exposed. Motors when combined with ceiling fans must be hung from insulated hooks or else there must be an insulator between the motor and its support. In direct-current 3-wire systems the neutral wire must be grounded. Transformer secondaries of distributing systems should preferably be grounded. Wires must be rigidly supported on non-combustible, non-absorptive insulators which separate the wire at least 1 in. from the surface wired over. They should preferably be run singly on separate timbers or studdings, and must be kept at least 5 ins. apart. Signaling wires must in no case be run in the same tube with electric light or power wires. The new rules for the manufacture of wired glass state that the wire mesh must not be larger than ⅞-in., and no wire smaller than No. 24 B. & S. gage should be used. The plane of the wire mesh should be practically midway between the two surfaces of the glass, and the maximum size of metal frame for holding the sash or glass must not exceed 5 ft. by 9 ft. between supports. In the new rules for the construction of fire doors and shutters it is stated that concrete for sills must be made of one part Portland cement, three parts of clean, sharp sand, and four parts of clean broken stone which will pass through a ⅝-in. mesh. The materials must be thoroughly mixed and the concrete well tamped and finished smooth and flush with the upper surface of the sill. The concrete should be a wet mixture.

CONSTRUCTION OF A FIREPROOF EXCURSION STEAMER.*

By William Gatewood,† M. Soc. N. A. & M. E.

The purpose of this description is to place on record the particulars of an adaptation of fireproof construction in the building of the "Jamestown," an excursion steamer for the Potomac River.

The vessel was built by the Newport News Shipbuilding & Dry Dock Co. from designs prepared by them to meet the requirements of the Norfolk & Washington Steamboat Co., and was put in service during June last.

The vessel has a length between perpendiculars of 250 ft., length over all 262 ft., beam over guards 63 ft., beam molded 38 ft., and depth molded 14 ft. 6 ins. Below the main deck are the barroom, pantry, galley and quarters for the crew. On the main deck are dining room, lobby, parlors and deck space for passengers, both open and inclosed. On the saloon deck are parlors, a few staterooms, toilets, a large inclosed cabin, and some open deck for passengers. On the shade deck are the pilot-house and rooms for deck officers, and a large open deck for passengers, covered by awnings. The propelling machinery consists of compound inclined engines, 30 ins. and 64 ins. in diameter with 66 ins. stroke, operating feathering paddle-wheels 17 ft. 3 ins. outside diameter. There are four single-ended Scotch boilers. The vessel is lighted by electricity. A speed of nearly 19 miles per hour was obtained on the trial trip in Chesapeake Bay.

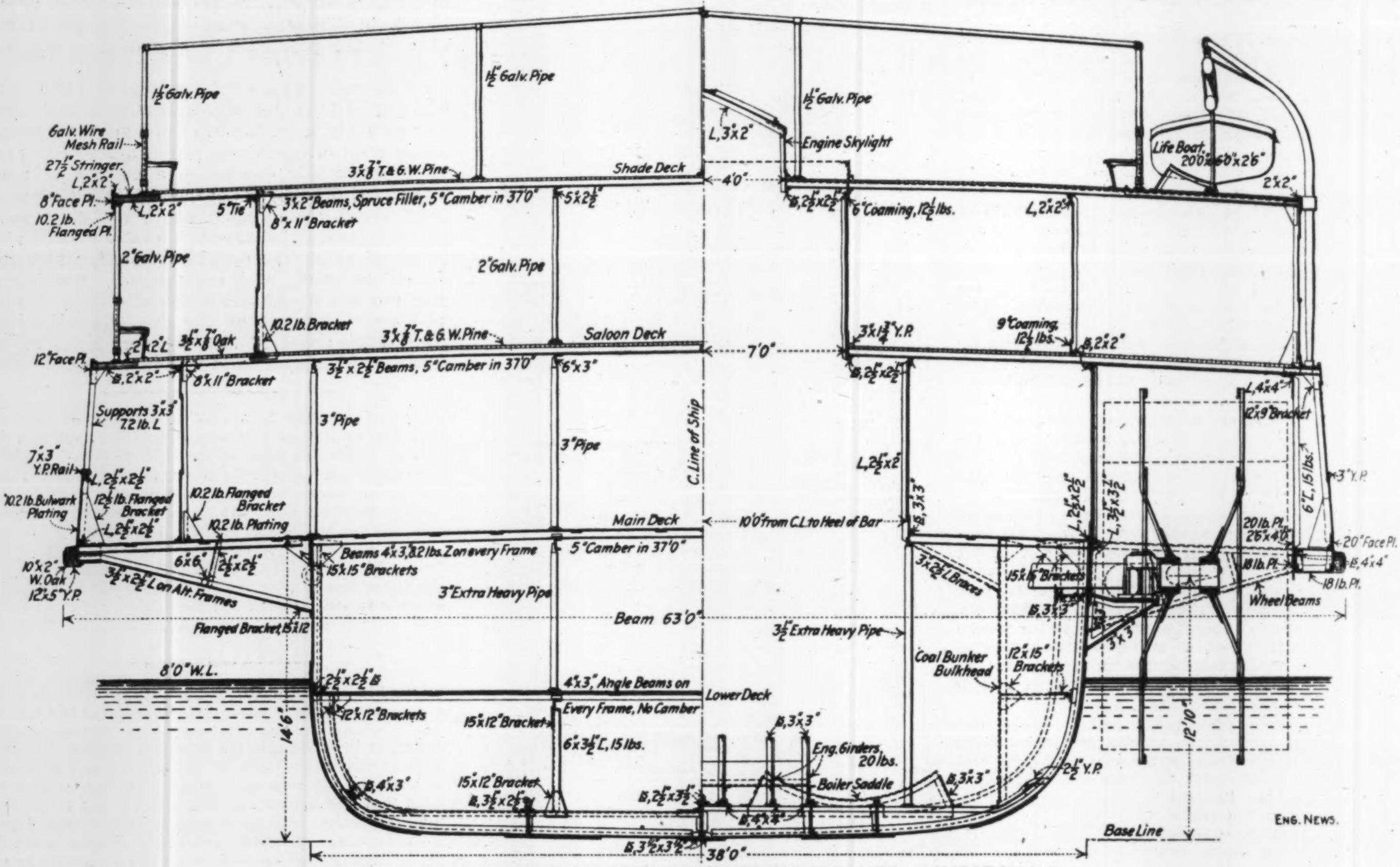

1½" Galv. Pipe
1½" Galv. Pipe
1½" Galv. Pipe
Galv. Wire Mesh Rail
27½" Stringer
L, 2"x2"
8" Face Pl.
10.2 lb. Flanged Pl.
L, 2"x2"
5" Tie
3"x⅞" T. & G. W. Pine
3"x2" Beams, Spruce Filler, 5" Camber in 37'0"
8"x11" Bracket
Shade Deck
5"x2½"
L, 3"x2"
Engine Skylight
4'0"
B, 2½"x2½"
6" Coaming, 12½ lbs.
L, 2"x2"
Life Boat, 20'0"x6'0"x2'6"
2"x2"
2" Galv. Pipe
2" Galv. Pipe
10.2 lb. Bracket
2"x2" L
3½"x⅞" Oak
3"x⅞" T. & G. W. Pine
Saloon Deck
7'0"
3"x1¾" Y. P.
9" Coaming, 12½ lbs.
B, 2"x2"
12" Face Pl.
B, 2"x2"
8"x11" Bracket
3½"x2½" Beams, 5" Camber in 37'0"
6"x3"
B, 2½"x2½"
L, 4"x4"
12"x9" Bracket
Supports 3"x3" 7.2 lb. L
3" Pipe
3" Pipe
C. Line of Ship
L, 2½"x2"
6" L, 15 lbs.
3" Y. P.
7"x3" Y. P. Rail
L, 2½"x2½"
10.2 lb. Bulwark Plating
12½ lb. Flanged Bracket
L, 2½"x2½"
10.2 lb. Flanged Bracket
10.2 lb. Plating
Main Deck
10'0" from C. L. to Heel of Bar
B, 3"x3"
L, 2½"x2½"
L, 3½"x3½"
20 lb. Pl. 26"x4'0"
20" Face Pl.
B, 4"x4"
18 lb. Pl.
18 lb. Pl.
Wheel Beams
10"x2" W. Oak
12"x5" Y. P.
6"x6"
2½"x2½"
3½"x2½" L on Alt. Frames
Beams 4"x3", 8.2 lbs. Z on every Frame
15"x15" Brackets
5" Camber in 37'0"
3" Extra Heavy Pipe
3"x2½" L Braces
15"x15" Brackets
B, 3"x3"
3"x3"
Flanged Bracket, 15"x12"
Beam 63'0"
3½" Extra Heavy Pipe
Coal Bunker Bulkhead
12"x15" Brackets
8'0" W. L.
2½"x2½" B
4"x3" Angle Beams on Every Frame, No Camber
Lower Deck
12"x12" Brackets
15"x12" Bracket
6"x3½" L, 15 lbs.
B, 3"x3"
Eng. Girders, 20 lbs.
Boiler Saddle
B, 3"x3"
12'10"
2½" Y. P.
14'6"
B, 4"x3"
15"x12" Bracket
B, 3½"x2½"
B, 2½"x3½"
B, 4"x4"
B, 3½"x3½"
38'0"
Base Line
Eng. News.

FIG. 1. A MIDSHIP SECTION OF THE EXCURSION STEAMER "JAMESTOWN."
Built by the Newport News Shipbuilding & Dry Dock Co.

By the term "fireproof," is not meant that the vessel is incapable of destruction by fire, but that the amount of combustible material has been limited to such an extent, and what remains is so protected and distributed that the chances of a fire starting on board are greatly reduced; and the spread of a fire would be practically impossible even should one get a start.

No trouble was experienced in this connection with the hull below the main deck, as it was constructed of steel throughout. Fig. 1 shows a midship section of the vessel.

The lower deck is built of steel plating $^3/_{16}$-in. thick laid on beams spaced 27 ins. to 30 ins. apart, and covered with linoleum, brick, mosaic tiling or interlocking rubber tiling, as the use of the spaces rendered desirable. In the machinery space, the floors are of ribbed plate, set on steel angle-supports. The main bulkheads are of steel plate, varying from $^3/_{16}$ to $^5/_{16}$-in. in thickness and stiffened with steel angles; and the main divisional bulkheads on the lower deck are also of steel plate ⅛-in. thick with angle stiffeners. The minor divisional bulkheads on this deck are of corrugated steel plate of No. 18 U. S. S. gage, with steel angle-boundaries.

The main deck is built of steel plating ¼-in. thick, on steel bearers spaced 24 to 36 ins. apart, with the stringer somewhat heavier. The runners under this deck are of steel channels and the beam stanchions are of iron pipe. The covering on the main deck is of rubber tiling or linoleum. The adherence of the rubber tiling or linoleum to the steel deck was obtained by the use of the special cement which it is customary to use for this purpose. The linoleum on this deck where it is exposed to the weather, is secured in addition by thin galvanized steel strips placed on top along the edges and across the joints, and secured through to the plating by brass machine screws. This latter arrangement is indicated by Sketch No. 1 in Fig. 2, and was considered necessary on the exposed deck on account of the liability of water soaking under the edge of the linoleum and thus spoiling the adhesion.

As was anticipated, much trouble was experienced in settling upon the design above the main deck. The following construction of the various parts above this deck was finally determined upon, and seems to have been satisfactory.

The waist or bulwark is built of ¼-in. thick steel plate with wood rail on top, stiffened by the bracketed steel angle-supports of the saloon deck, and by intermediate angle-stiffeners. Abreast the wheels and in way of the toilet and parlors amidships, the side was extended to the saloon deck by plating $^3/_{16}$-in. thick, with angle-stiffeners.

Where the houses on this deck do not extend to the side, they are built of $^5/_{32}$-in. thick plating, with angle-stiffeners bracketed to the main deck.

The finish inside of these houses was obtained by steel ceiling of No. 24 U. S. S. gage, secured by brass wood screws to wood grounds bolted to the stiffeners. The wood grounds serve also as guides for the windows. The window sashes are of oak, and the usual wood blinds are replaced by roller curtains. The arrangement of this ceiling is shown by Sketch No. 2. The edges of the ceiling were crimped to make a neat finish.

The machinery casings are of steel $^5/_{32}$-in. thick, with stiffeners alternately of angles and tee bars, the latter serving as butt straps and fitted with flanges outside, giving a panel effect. The casings are lined in way of the boiler rooms with No. 24 U. S. S. gage steel, to which is secured asbestos air cell 1-in. thick to prevent the radiation of heat into the passenger quarters outside. This construction is shown by Sketch No. 3. It will be noticed that small iron clips were riveted to the stiffeners to take the screws for securing the ceiling, and the use of wood for this purpose was thus avoided.

Air cell asbestos is also fitted under the main deck over the boiler-room, engine-room and galley, resting on metal strips secured to the bottom flange of the beams, to help prevent the transfer of heat through the deck—a result accomplished on other vessels by the wood decks.

Boundary bulkheads on the main deck are constructed in a similar manner to the casings, and sheet steel pilasters are fitted over the standing flanges of the angle or tee bar stiffeners for appearance sake, as shown by Sketch No. 4.

It was at first considered practicable to build the saloon and shade decks of light steel riveted to steel beams, but after several experimental sections had been built it was decided that exposure to the sun and weather, and the difficulties attendant upon buckling due to the riveting of thin material, would require a thickness of plating of not less than $^3/_{16}$-in. The weight of $^3/_{16}$-in. plating rendered the use of such thick plating at this height out of the question on account of the reduction in stability which would have been caused thereby. It was decided, therefore, to use steel angle beams turned upside down, with a pine nailing strip bolted to the vertical flange and resting on the horizontal flange, and on this to lay ⅞-in. pine decking. The under surface of the decking was then covered with thin sheet steel, and a cornice of the same material was fitted over the nailing strip and on the other side of the beam as well, to give a finish. This steel ceiling was not smooth but was rolled with shallow corrugations. The cornice and ceiling were secured by wire nails. As will be seen by reference to Sketch No. 5, there is no wood left exposed on the under side of these decks. Steel face plates, stringer plates, and tie plates are fitted for these decks, and the runners under the beams are of steel bulb angles, with iron pipe stanchions.

Linoleum was used as floor covering on the saloon deck where not exposed to the weather, that fitted in the main saloon being of the standard battleship grade, of a thickness exceeding ¼-in. The covering to be used on the exposed portions of the saloon and shade decks was, however, a subject of much consideration. The usual canvas was not considered a satisfactory covering on account of the danger from fire, as lighted cigar ends, etc., have been known to cause trouble on canvas decks. It was thought that some form of asbestos tiling could be used for this purpose, but samples were tested and found to be unsuitable, as the asbestos tiles were not tough on the surface to stand the wear; and the adhesion between the tiles and the cement used in laying was also defective after exposure. It was finally decided to cover the wood decking with canvas to secure watertightness, and on this to lay interlocking rubber tiling. This presents an elegant surface, and in general seems to have served the purpose, although some difficulty was experienced on the shade deck, due partly to lack of care in laying and partly to the action of the weather. On account of the weight and expense, the use of interlocking rubber tiling for this purpose leaves much to be desired, even though satisfactory adherence to the deck is obtained.

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*A paper read at the fourteenth general meeting of the Society of Naval Architects and Marine Engineers, held in New York, Nov. 22 and 23, 1906.

†Chief Draftsman, Hull Department, Newport News S. B. & D. D. Co., Newport News, Va.

In this connection the suitability of heavy linoleum for this purpose will probably be shown by the small amount which was laid on the exposed main deck. Heavy linoleum makes a fine deck covering for protected decks where the surface can be kept coated with shellac. The floor of the main saloon on this vessel, which is fitted with heavy linoleum, makes an excellent surface for dancing. If linoleum is laid on weather decks it would seem necessary to fit metal strips over all the joints, and the surface could hardly compare with that of the interlocking rubber tiling as fitted on this vessel. Sketch No. 6 shows the method adopted for ending the wood deck and its covering at the edge of the waterway at the side of the vessel.

The house on the saloon deck is built of $^5/_{32}$-in. steel plates, stiffened with angles and lined with No. 24 gage sheet steel in a similar manner to the house on the main deck, and considerable care was taken to bracket the stiffeners to the beams, so that the rigidity of the structure might be maintained, although the material was so thin. By reference to Sketch No. 2 will be seen how the drip from the windows was led into the waterway behind the ceiling and taken off by scuppers at intervals; and also how the lower portion of the ceiling was made separate so as to be more readily removable for access to this waterway. Divisional bulkheads on all the decks are built of No. 18 gage sheet steel, corrugated for stiffness, with corrugations about 1¼ ins. deep and 8 ins. apart.

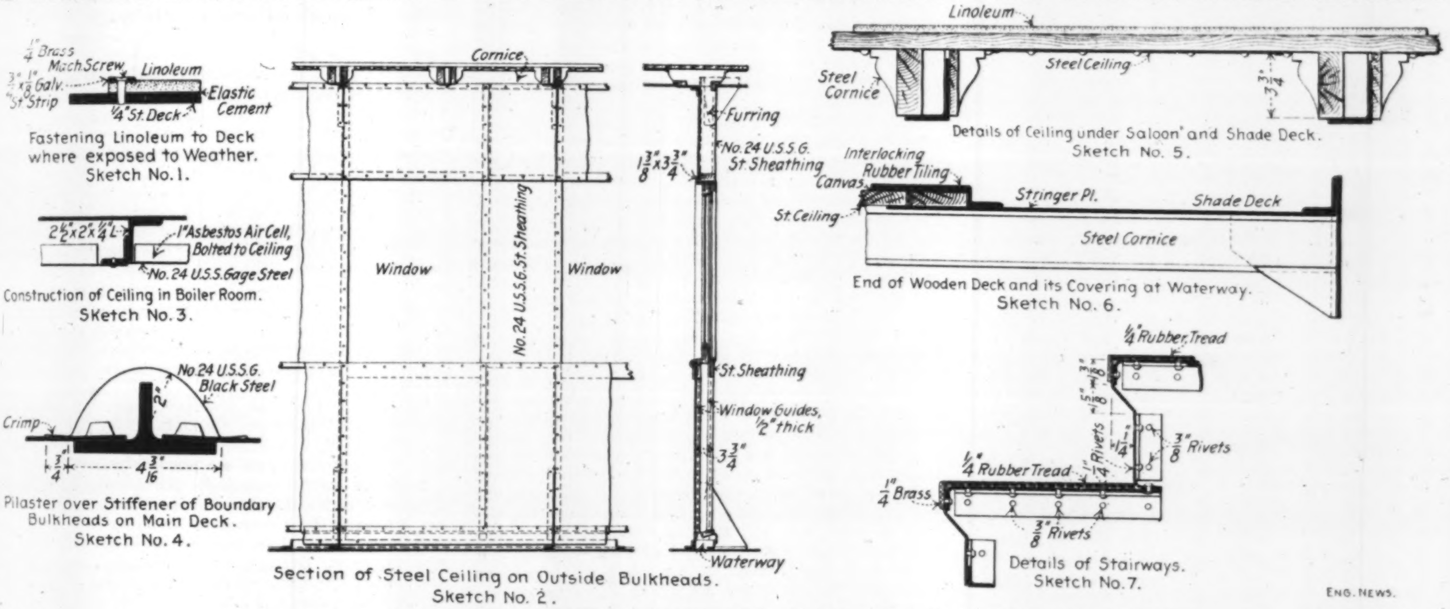

FIG. 2. SEVEN SKETCHES SHOWING THE FIREPROOF CONSTRUCTION OF THE "JAMESTOWN."

Fastening Linoleum to Deck where exposed to Weather. Sketch No. 1.

Section of Steel Ceiling on Outside Bulkheads. Sketch No. 2.

Construction of Ceiling in Boiler Room. Sketch No. 3.

Pilaster over Stiffener of Boundary Bulkheads on Main Deck. Sketch No. 4.

Details of Ceiling under Saloon and Shade Deck. Sketch No. 5.

End of Wooden Deck and its Covering at Waterway. Sketch No. 6.

Details of Stairways. Sketch No. 7.

The pilot house and officer's rooms on the shade deck are built in a similar manner to the house on the saloon deck, with corrugated metal partition between the rooms. Some slight trouble has been experienced with the compass on account of its proximity to so much steel work and it is not quite as quick moving as usual. The expense entailed would not permit of the construction of the pilot house of brass, the only other fireproof material available, as is done on the recent vessels of our navy.

The stairways are constructed of metal and the steps are covered with ribbed sheet rubber. Sketch No. 7 shows the construction. The rails on the stairways are of galvanized iron pipe, and around the wells metal grillework is fitted.

The guard rails are of pipe, with pipe stanchions and with galvanized wire mesh panels.

In connection with the painting, it should be noted that cork was liberally used, as condensation and "sweating" are thereby reduced, and the use of thin metal rendered very necessary the elimination of this cause of corrosion.

The use of wood in the furnishing of the vessel was reduced to a practicable minimum. Bedsteads are of brass or enameled iron, plumbing is of the open type, and clothes lockers are of sheet metal.

The electric wiring is led in steel conduit.

The life preservers, where stowed overhead, are held up by heavy twine instead of the usual wood battens.

The construction of this vessel may be summarized as being of steel, the use of wood having been eliminated as far as practicable, and most of the wood that is used is covered with non-inflammable material.

* * *

EXTRACTS FROM THE ANNUAL REPORT OF THE ISTHMIAN CANAL COMMISSION FOR THE YEAR ENDING DEC. 1, 1906.

Sir: The Isthmian Canal Commission has the honor to submit its annual report for the year ending Dec. 1, 1906.

During the year the first stage of canal work, that of preparation, has virtually been past, and the Commission finds itself in a position to enter upon the second stage, that of actual construction of a lock canal at an elevation of 85 ft., authorized by Congress in June last.

Of these two stages the first was at once the more difficult and the more important. If not done thoroughly and intelligently in every part the actual work of construction would be handicapped from the start. It was necessary, as in launching of any great enterprise, to create an organization with which to work. It was necessary also to make the Isthmus, by thorough sanitation, a healthful place in which to work; to provide suitable quarters and food for employees; to construct proper terminal yards and railway tracks and intermediate yards for the handling of the vast quantities of materials and supplies; to install a system of railway tracks through the cuts; to put the various levels in the cut in proper condition for the installation and operation of the maximum number of steam shovels; to purchase and assemble the plant for constructing the canal; to work out all engineering problems; to perfect a government and create a system of accounts, and to formulate a preliminary plan for carrying forward the work in each department.

SANITATION.

The work of sanitation throughout the Canal Zone has been continued with great energy during the year. The most serious problem that confronted the health department when it was organized two years ago was the elimination of yellow fever, which had been an important factor in the failure of the French company and was regarded as one of the most formidable obstacles to American success. This obstacle has been completely removed. Although there has never been so large a number of nonimmunes on the Isthmus as during the past year, there has not been a single well-authenticated case of yellow fever during that period. The last case in Panama was on Nov. 11, 1905. There was a single case in Colon on May 17, 1906, which was officially declared to be yellow fever, but the medical authorities were not clear that this diagnosis was correct. It did not result in the spread of the infection.

The Isthmus is now completely free of this disease, an achievement which demonstrates the high efficiency of the health department. In combating other diseases the department has been scarcely less successful. The average daily sick rate among employees of the Commission during the ten months from Jan. 1, 1906, to October 31, 1906, was 28 per thousand, which is no higher than might be expected in an equal body of laborers engaged in construction work in any part of the world. During the same period the death rate among the whites was about 17½ per thousand, and among the blacks nearly 53 per thousand.

CARE OF EMPLOYEES.

Great progress has been made during the past year in providing for the welfare and comfort of the employees. The Commission now has sufficient buildings to provide quarters for all its bachelor employees. These buildings are screened, and provided almost universally with running water and with modern plumbing, and are comfortably furnished. In addition to these buildings, 335 separate houses and 13 larger buildings have been constructed for married quarters, providing accommodations for 375 families. There are still many married men, however, for whom no quarters are available, but upon the completion of the houses now authorized these will be provided for. There are now approximately 1,200 American women and children on the Isthmus.

RECREATION FOR EMPLOYEES.

The Commission has made some progress in its efforts to provide means of amusement and recreation for its employees, but not so much as would have been the case had it not been for the continued stress of work of more vital importance. Although the Commission in November, 1905, authorized the construction of clubhouses at a cost not to exceed $7,500 each, it has not been found possible as yet to erect many new buildings under this authority, but a building has been set aside at Cristobal for the use of a club there, and four are in process of construction—at Culebra, Empire, Gorgona, and Cristobal. Two of these at Culebra and Empire, will be ready for use early in 1907. The problem of entertainment and recreation, however, has been solved in a measure by the employees themselves, who have established clubs of various kinds, fraternal orders, and athletic associations in various places along the line of the canal.

PERSONNEL.

In November, 1905, the Commission's employees numbered approximately 17,000, and in November, 1906, the number was practically the same. Of these, 12,612 were under the department of construction and engineering; 1,129 under the division of material and supplies; 2,291 under the department of government and sanitation, and 137 in the auditing and disbursing offices.

Of the 17,000 men, about 3,700 were on the gold rolls, virtually all white Americans, and 13,300 on the silver rolls, mainly aliens. This number does not inclue 4,000 people employed on the Panama Railroad.

The above number represents the approximate number that was actually on the pay rolls for the end of November, 1906, and does not include a large number of men—especially West Indian laborers—who for various reasons are not continually employed by the Commission, but who possibly work a few months each year and who are nevertheless under the jurisdiction of the Commission as far as quartering, police, and sanitation are concerned. Including these men, there are in round numbers about 25,000 men under the direct jurisdiction of the Isthmian Canal Commission and Panama Railroad Company.

UNSKILLED LABOR.

Another year's experience with negro laborers from nearby tropical islands and countries has convinced the Commission of the impossibility of doing satisfactory work with them. Not only do they seem to be disqualified by lack of actual vitality, but their disposition to labor seems to be as frail as their bodily strength. Few of them are steady workers. The majority of them work just long enough to get money to supply their actual bodily necessities, with the result that while the Commission is quartering and caring for about 25,000 men the daily effective force is many thousands less. Many of them settle in the jungle, building little shacks, raising enough to keep them alive, and working only a day or two occasionally, as they see fit. In this way, by getting away from the Commissioner's quarters, practical control over them is lost, and it becomes very difficult for foremen to calculate on keeping their gangs filled.

The most serious question in regard to this class of laborers is that of feeding them, ordinary methods having failed to induce them to take sufficient nourishment to give them the physical strength necessary to enable them to work efficiently. To such an extent is this true that the Commission is seriously debating whether to make the basis of employment a certain rate per hour and board, or a certain rate per hour and deduct a fixed amount per day for board.

The experiment with laborers from northern Spain has proved very satisfactory. Their efficiency is not only more than double that of the negro, but they stand the climate much better. Since the 1st of January there have been about 900 of these at work on the canal, and of this number not one has died from disease. They have malaria in about the same degree as the white Americans, but not at all to the extent that the negroes have it, and there has not been a single case of yellow fever among them. Their general condition is about as good as it was in their homes in Spain, and they stand the climate very much better than the negroes. The chief engineer is convinced by this experiment that "any white man, so-called, under the same conditions, will stand the climate on the Isthmus very much better than the blacks, who are supposed to be immune from practically everything, but who, as a matter of fact, are subject to almost everything."

Employees are secured either through the Civil Service Commission, employment agents, or personal application.

On Jan. 12, 1906, by Executive order of the President, all employments on the Isthmus of Panama were excepted from civil service examination, with the exception of the following named: Clerks (all kinds), bookkeepers, stenographers, typewriters, surgeon, physician, interne, trained nurse, and draftsman.

Applications for employment in the excepted positions, including, among others, all the mechanical trades, railroad and civil engineering positions, are selected by means of employment agents of the Canal Commission traveling in various sections of the United States. The Commission is in daily receipt of a large number of applications from persons with ordinary all-round experience. The service of these persons, however, can not be utilized, as they have not specialized along any particular line of work.

ENGINEERING WORK OF THE YEAR.

The engineering work of the year has been almost entirely preparatory. Owing to the delay in the decision as to the type of canal it was impracticable to locate permanent and well-arranged dumping grounds for the disposal of waste material. The general plan of the work which has been done in the Culebra cut has been in putting the various levels in proper condition for the installation of the maximum number of steam shovels, and the construction of a system of railways on each level and a double track at the bottom, connecting with yards established along the line of the Panama Railroad. While no especial effort has been made to get out yardage, yet during the fiscal year the amount of material excavated from the canal prism was 1,500,000 cu. yds., as against 742,000 cu. yds. the previous fiscal year.

There was available in September, 1906, a total force of 46 steam shovels, of which 27 were at work in the canal prisms, 2 outside the prism, 4 on the Panama Railroad, and the rest set up and ready for work in various places.

The main receiving and forwarding yards, one on each side of the cut, which are to act as clearing houses for the dirt trains moving down from the various levels of the cut to the yards, there to be switched and forwarded over the main line of the Panama Railroad for final disposition, are practically completed at Pedro Miguel on the Pacific side and Las Cascadas on the Atlantic side.

THE PANAMA RAILROAD.

Great progress has been made during the year in enlarging and improving the facilities of the Panama Railroad so as to enable it to perform adequately its double functions of handling general commercial business and at the same time serving as the essential instrument in the construction of the canal.

There has been no congestion of freight on the Isthmus since the middle of December, 1905, and with the completion of new wharves and docks and the addition of larger equipment and heavier power constantly arriving, there is slight possibility of congestion in the future.

Of the 35 miles of additional track contemplated, about 20 miles have been completed and are ready for use, and the remaining 15 miles are about 75 per cent. completed. The probability is that sections of the road will require three or four tracks.

The new railway equipment, ordered in 1905, partly by the Commission and partly by the Panama Railroad Company, has in large measure been delivered on the Isthmus. Of the portion ordered by the Commission there have been delivered 92 locomotives, eight hundred 40-ton flat cars, 325 dump cars, four 10-ton and four 20-ton locomotive cranes, 2 dipper dredges, and 1 tugboat. Of that ordered by the Panama Railroad Company there have been delivered 24 locomotives, 500 box cars, 12 caboose cars, 6 passenger coaches, 10 refrigerator cars, 100 ballast cars, 2 flat cars, 1 tugboat, 2 wrecking cranes, and 1 pile driver.

The total amount of purchases made for the year ended June 30, 1906, was $8,743,482.05.

The work of the division of material and supplies on the Isthmus has been reorganized and new and modern methods of handling material have been installed. One general storehouse has been established at Mount Hope, near the Atlantic entrance to the canal, which is the general supply depot for the entire work on the Isthmus.

The total stock of materials and supplies on hand June 30, 1906, in charge of the division of material and supplies, which have been purchased since the United States took charge of the work on the Isthmus, amounted to approximately $1,400,000.

LOCATION OF LOCKS AND DAMS.

Since the decision by Congress, in June last, decreeing the construction of a lock canal at an elevation of 85 ft. the Commission has fixed definitely the location, on the Atlantic side, of three sets of locks and a great dam at Gatun, and, on the Pacific side, of one set of locks at Pedro Miguel and two sets at La Boca and two dams in the vicinity of La Boca, a large one between Sosa High and Corozal, and a smaller one between Sosa High and San Juan Hill.

PROPOSALS TO FURNISH CHINESE LABOR.

On Aug. 20, 1906, the Commission issued invitations for proposals to furnish 2,500 Chinese laborers for work upon the canal for a period of not less than two years with the privilege of increasing the number to 15,000. Four bids were presented, of which the only two accepting the Commission's terms were also the lowest. These bids agreed to furnish the laborers from 9 to 11 cents per hour, dependent upon the number actually employed. The selection of the bidder has not yet been made.

PLAN OF REORGANIZATION.

In harmony with the plan of procuring a more direct method of administering the affairs of the Commission, an Executive order was signed by the President on Nov. 17, 1906, during his visit to Panama, amending the Executive order of April 1, 1905, under which the Commission had been previously reorganized. The work is now divided among the following departments: The department of engineering and construction, the department of law and government, the department of sanitation, the auditing department, the purchasing department, the disbursing department, and the department of labor, quarters, and subsistence. The head of each department is rendered directly responsible for the work carried on under his direction. They are all appointed by and report directly to the chairman of the Commission, who, in turn, is responsible to the President through the Secretary of War, for the conduct of the enterprise as a whole.

Respectfully submitted,
T. P. Shonts,
Washington, D. C., Dec. 6, 1906. Chairman.

EXTRACTS FROM THE REPORT OF THE CHIEF ENGINEER OF THE ISTHMIAN CANAL COMMISSION.

COLON DIVISION.

At the beginning of the year an old French dredge had been repaired and was engaged in deepening the channel in the inner harbor. At that time there was an available channel of about 20 feet in depth leading to wharf 11 and a depth of about 18 feet up to wharf 14. Dredging of this channel has continued throughout the year, with the exception of interruptions incident to such operations. The slip between piers 1 and 2 in Colon was dredged out three times, but up to Dec. 1, 1905, the dredge was operated twelve hours per day and since that time twenty-four hours per day six days in a week.

A total of 866,500 cu. yds. of material, scow measurement, was removed, of which 58,500 yds. was coral rock, the remainder being mud and silt, and the cost per yard of the entire amount, including all labor, material, and running repairs, but not including depreciation of plant or administration expenses, was 8.9 cents.

A contract was entered into with George W. Catt, of New York, in August for two dipper dredges, one intended for La Boca and one for Colon, these dredges to have 5-yard dippers and dredge to a depth of 40 ft., hulls of steel, 110 feet long, 38 feet wide, and 10 feet deep. One of them is being erected in Cristobal, the other erected in La Boca. The work of delivery of these dredges is badly delayed, and the entire contract can not be completed in the time specified.

A contract for the construction of two lar[illegible] going dredges was let in June to the Maryland Ste[illegible] pany, but at the end of the year work was not com[illegible] d and contract has been let for the construction o[illegible] steel dump barges.

The work on the Gatun section has been [illegible] d to surveys and the boring of test holes to dete[illegible] e the character of the material along the canal a[illegible] the vicinity of the proposed lock and dam at Gatu[illegible] rveys of the main line of the old canal with bor[illegible] were made between Gatun and Bohio and also north [illegible] atun.

Topographical surveys have been made in t[illegible] inity of the proposed lock and dam and addition[illegible] rveys made between Gatun and Mindi. Thirty-six [illegible] holes were put down along the axis of the dam, [illegible] ng a total depth of 25,000 ft., the deepest being 2[illegible] below the surface. One hundred and eight hole[illegible] aving a total depth of 9,000 ft., were put down at [illegible] location of the proposed lock, about sixty of the[illegible] aving been extended to a depth of 60 ft. below [illegible] level. Thirty-two holes were put down on the site of [illegible] proposed spillway.

CULEBRA DIVISION.

As has been indicated to you both by verbal and written reports from time to time, the work on this division, during the past year, has been almost entirely preparatory, no special attempt having been made to get out yardage, but rather to take out the barriers, so called, which were left by the French at different points in the canal excavation, and to get the prism in shape by putting in tracks and doing other work so that a larger output could be handled once the type of canal was decided upon. The equipment trackage was completed and the necessary yards and dumping grounds arranged for.

Owing to the great delay in the decision as to the type of canal, which decision was not made until the end of the year, it was impracticable to locate permanent and well-arranged dumping grounds for taking care of the waste material. Owing also to the absence of proper equipment, which had not begun to arrive in quantities sufficient to make economical and rapid work practicable until the close of the year, operations were necessarily carried on by the use of the old rolling equipment which came to us from the French and which is altogether unsuitable for the work. Only a few small size modern dump cars were received by the close of the fiscal year, and many of these were necessarily used in hauling coal, crushed rock, brick, and other material, owing to the lack of equipment on the Panama Railroad, so that none of the new rolling equipment, quantities of which were ordered in September, was received in time to be of any practical benefit.

During the year the amount of material excavated from the canal prism was 1,500,000 cu. yds., at 79.5 cents per cubic yard, as against 742,000 cu. yds., at a cost of 58.6 cents per cubic yard the previous year.

There are several reasons for the increase in cost, one being that during the previous year during the months of the dry season there were only 7.8 inches of rainfall, and during that time 60 per cent. of the output for the year was taken out. During the same months of the past year there was 18.4 inches of rainfall, and only 54 per cent. of the total output was taken out during that time.

Another important consideration is the fact that during the past year nearly 49 per cent. of the material excavated was actually mined—that is, drilled and blasted—while during the previous year a little less than 13 per cent. of the material excavated required drilling and blasting; in other words, soft material was moved during the preceding year, and hard, or above the average hardness, during the past year.

Another item of expense is that during this year we have only worked eight hours per day, while during the entire previous year ten hours were worked per day, and while the hours per day have been decreased the wages have been increased from 25 to 50 per cent.

The general plan of work which has been done in the cut has been to shape the prism up, which was left in bad shape by the French, so that systemized trackage may afford room for the working of steam shovels, together with the necessary tracks connecting with yards established along the line of the Panama Railroad—in other words, to work out the proposition to a practical transportation standpoint, and not by piecemeal, as has been done.

At the beginning of the year there were 1[illegible] shovels erected and ready for work. At the close of the year we had 39 shovels complete, 300 western dump cars, and 560 40-foot flat cars, the dump cars and flat cars having been received late in the year.

At the beginning of the year there were in operation 35 miles of track, and of this amount only 15 miles were laid with American steel. During the year 4[illegible] miles of new track were completed and 11½ miles of old French, all the new and old track being laid with new American steel. There are now at present in good shape in the cut what may be termed 70 miles of new track in operation.

There has been built during the year a yard at Pedro Miguel of nine tracks, each 1,600 feet long, also a modern ve coaling plant, repair and other tracks neces- There has been built at White House two yards, five tracks and one of four tracks, each 1,600 ft. also a coaling plant erected, an engine house under ruction, and other necessary facilities for the proper ling of work trains out of yards.

at progress and improvement has been made in the ating department. This was formerly known as the ng department, and for the first three or four hs, until this section of the work could be properly nized, the steam shovels were delayed on account of delay in drilling and blasting; but at the present time work is being conducted so that not only is the drill- nd blasting kept ahead of the shovels, but the min- has made a gain of 1,250,000 cu. yds.; in other ds, that much ahead of the shovels.

ere were 585,007 pounds of explosives used during year, of which 146,103 pounds were black powder and balance dynamite.

til the end of the year we had no modern locomo- and very little modern rolling stock, consequently improvement for the transportation department has been very marked, but with the completion of the uble track of the Panama Railroad, which is now well along, so that our trains will not be delayed in getting over the road to the dumping grounds, the cost of transportation can be reduced at least 50 per cent., and the transportation proposition, including the dumping of the material, is the greatest problem connected with the excavation of the Culebra cut.

Culebra, Aug. 11, 1906.

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NEW YORK'S NEW SUBWAYS.

At the official opening on Oct. 27, 1904, of the present New York Subway, Mayor McClellan in his address, said:

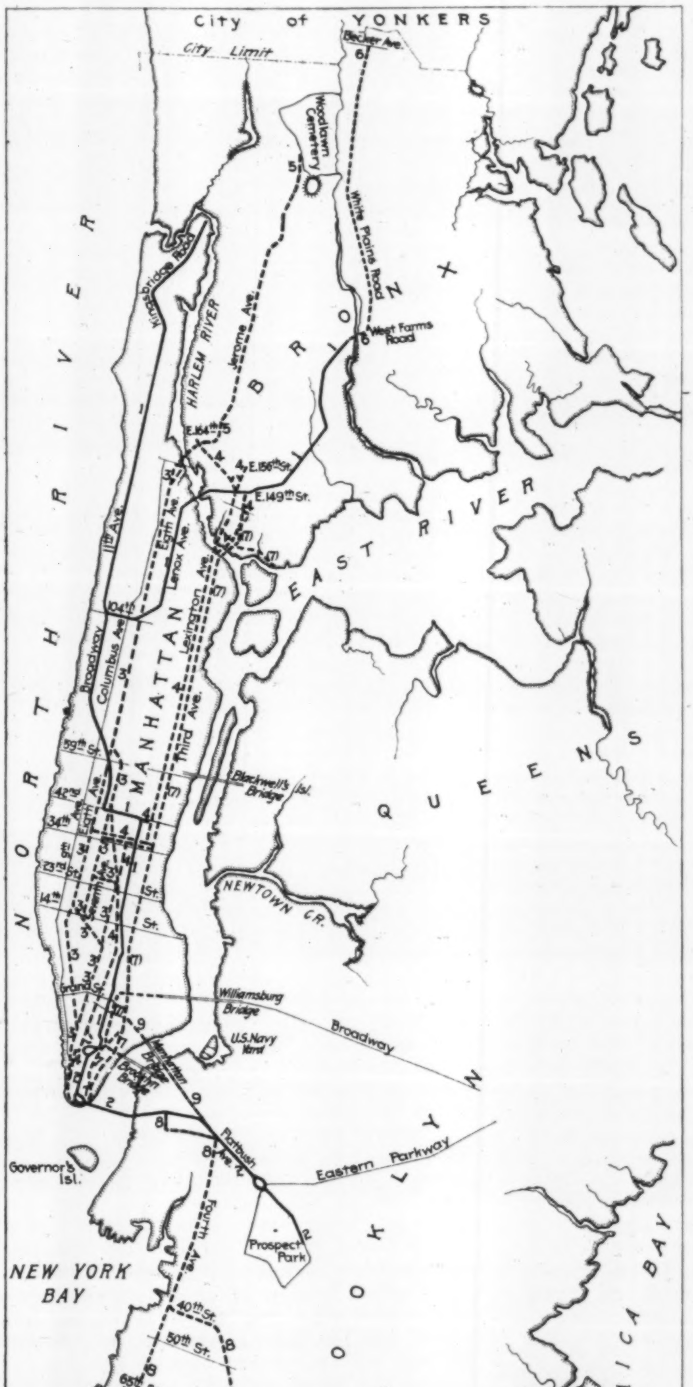
"If this new underground railroad that we are about to open proves as popular and as successful as I confidently expect it to be, it will only be the first of many more that must ultimately result in giving us an almost perfect system of interborough communication."

In our issue of Dec. 13 (page 629), we recorded the approval of the Board of Estimate of seven new subway routes for New York City and the instructions for the Rapid Transit Commission to secure bids, first, for the construction of the subways alone; and, second, for their construction and operation. This fulfillment of the Mayor's prediction may be taken as a proof that the present subway has proved both popular and successful. So popular and successful is it, in fact, that during certain hours its capacity is already taxed to the limit.

The present subway proper has its southern terminus at the lower end of Manhattan Island. From this point to its northern terminii, the one at Kingsbridge in the Borough of Manhattan, and the other at Bronx Park in the Borough of Bronx, there are approximately 20 miles of railway. The work of construction was begun on March 24, 1900, and the total cost was $41,000,000, of which $35,000,000 was for the construction, and $6,000,000 for the equipment.

The Brooklyn extension of the present subway system, which is now approaching completion, extends from the present southern terminus, under the East River to Brooklyn, terminating at the junction of Flatbush and Atlantic avenues. The entire extension is about 5½ miles long and will cost $3,000,000, of which $2,000,000 is for construction and $1,000,000 for terminals.

The routes of the seven new subways to be built by the City of New York were selected by the local authorities from nineteen routes proposed by the Board of Rapid Transit Railroad Commissioners. The selection of these routes involved long and painstaking study. Natural advantages and the natural trend of population were considered; also the relation of one section to another, with Manhattan as a center, and the location of the routes, so as to permit of expansion in the future without disturbing the efficiency and symmetry of the system as a whole, were among the important features to be weighed. Furthermore, it was advisable to have the subway lines operate in connection with some existing means of passenger transportation, to have each capable of separate operation, and be practicable to build at once, both from the engineering, transportation and financial standpoints.



MAP SHOWING THE ROUTES OF THE SEVEN NEW SUBWAYS IN THE BOROUGHS OF MANHATTAN, BRONX AND BROOKLYN.

1. Present New York Subway.
2. Brooklyn Extension of Present New York Subway.
3. Seventh and Eighth Avenue Route.
4. Lexington Avenue Route.
5. Jerome Avenue Route.
6. West Farms and White Plains Route.
7. Third Avenue Route.
8. Fourth Avenue and Bensonhurst Route.
9 (7) and 8. Tri-Borough Route.

As embodying to the greatest extent the foregoing considerations, the following routes were chosen: Seventh and Eighth avenue route, Lexington avenue route, Jerome avenue subway, West Farms and White Plains route, Fourth West Farms and White Plains route, Third avenue route, Fourth avenue route and Bensonhurst route, and the tri-borough route, connecting the Bronx, Manhattan and Brooklyn.

Considering these routes in the order named and with reference to the accompanying map, the Seventh and Eighth avenue subway comprises a 4-track line extending from Battery Park to 154th street and Eighth avenue, all in the Borough of Manhattan and all under ground. This line covers pretty thoroughly the lower western portion of the city and that part of the Harlem section lying between the Broadway and Lenox avenue branches of the present subway. Between Forty-third and Forty-seventh streets a connection will be made with the present subway.

The Lexington avenue route extends from Battery Park up the central portion of the city to Thirty-fourth street; thence up the East Side to the Borough of the Bronx where it diverges into three branches, one of which, the main branch, connects with the present subway at East 149th street, and the other two branches cover the lower western portion of the Bronx. This line will also connect with the present subway at Forty-second street and Park avenue. It will, for the most part, be of 4-track construction, although two of the branches and the extreme lower portion of the line will be 2-track subway. From end to end this line will be below the surface. It will, to a very great extent, relieve the present subway from the heavy traffic of the Bronx, and will supply the East Side dwellers in Manhattan Borough with rapid transit facilities equal to those now afforded the West Side by the present subway system.

The Jerome avenue route consists of a 2-track subway extending from 154th street and Eighth avenue, Manhattan Borough, under the Harlem River, to 161st street and Jerome avenue; thence a 4-track subway through Jerome avenue to Woodlawn Cemetery. This line will connect with the Sixth and Ninth Ave. elevated roads in Manhattan and will afford easy access to Van Cortlandt Park, Woodlawn Cemetery, and the outlying districts of the Bronx.

The West Farms and White Plains route will consist of an elevated 2-track railway in the Borough of the Bronx, connecting with the terminus of the present subway at East 172d St. and West Farms Road and crossing the Bronx

River; from this point a 3-track elevated line will extend up White Plains Road to 241st St. This new railway will run within a few blocks of the city line and will thus place the city of Yonkers practically within New York's rapid transit zone.

The Third Ave. route comprises a 2-track subway from Battery Park up Pearl St. to Chatham Square, thence a 4-track subway up the Bowery and Third Ave. to 128th St., and from there on a 2-track subway into the Bronx.

The Fourth Ave. and Bensonhurst route lies in the Borough of Brooklyn. It consists of a 4-track subway to connect with various lines in the heart of the city of Brooklyn (among which are the Brooklyn extension of the present New York Subway and a railroad that will run over the Manhattan Bridge) and run through Fourth Ave. to 100th St. at Fort Hamilton, and also by a 4-track subway from 36th St. and Fourth Ave. to Surf Ave. at Coney Island.

The tri-borough route connecting the Bronx, Manhattan and Brooklyn, includes in the Borough of Brooklyn the Fourth Ave. and Bensonhurst route just described, also a 2-track subway from this line over the Manhattan Bridge to connect in the Borough of Manhattan with the Third Ave. subway extending from Battery Park to the Borough of the Bronx.

An additional feature of the tri-borough route is a 4-track subway in Manhattan, running from the Williamsburg Bridge through Delancey St. and Center St. to the proposed new terminal of the Brooklyn Bridge.

The total length of the seven new subways is approximately 66 miles. It is estimated the construction and equipment of these will require over $150,000,000.

In accordance with the Elsberg bill, the term of the franchises granted by the city for the operation and construction of subways, expires at the end of 20 years, but may be renewed for a second 20-year term.

The construction of the new subways will not differ materially from that of the present one, except that more concrete-steel construction will be used and more attention will be given to the matter of ventilation in the original designs. Practically all of the stations will be located between cross-streets and not on corners, so that at each station there will be entrances and exits from two thoroughfares. The cars will probably be built without platforms but with two extra wide doors on each side, so that the time required for loading and unloading will be considerably less than it is under present conditions.

HOW A BARREL OF OLIVE OIL SAVED THE STAFF OF THE NAVY; AN INCIDENT IN AMERICAN NAVAL HISTORY.

By F. P. Albert.*

A few of the older generation of engineers still living may recall the heated controversy which was waged about the middle of the last century concerning the expansion of steam. In these days, when even schoolboys are familiar with essential principles in steam engineering, it is difficult to realize that a half century ago what now seem simple matters of everyday knowledge were veiled in mystery and were subjects of keen dispute among engineers.

It was about the middle of the century that attention was turned to the topic of steam expansion by the inventions of Corliss and Sickles, who substituted for the old throttling governor the automatic cut-off.

As is frequently the case with new inventions, the most extravagant ideas were put forward regarding the possibilities of this system. Little was then known by practical men concerning thermo dynamics, and the claims that a very little steam, cut off near the beginning of the stroke and allowed to expand in the cylinder, would do an enormous amount of work found plenty of believers.

The advocates of high steam expansion were particularly anxious to force their inventions into the United States Navy. They overlooked the fact that the mill engines with which they had been successfully working carried a variable load, where a marine engine carries a uniform load, and they were ignorant of the limitations to the economy of high ratios of steam expansion with the low pressures which were then in use.

The result was that the inventors and their backers were brought into conflict with engineers of the Bureau of Steam Engineering, and a spirited controversy arose, particularly between Mr. B. F. Isherwood, then Chief of the Bureau, and Mr. E. N. Dickerson, a versatile patent lawyer of New York City and counsel for Mr. Sickles, the inventor of "Sickles Cut-Off," over the subject of steam expansion.

It may be here remarked that Mr. Isherwood had made his position entirely secure by the famous series of experiments on steam expansion carried on by him in the early '60's on the U. S. Steamer "Michigan" on the Great Lakes. It must be remembered that these were the days of low steam pressures and low piston speeds; 20 lbs. boiler pressure was considered high. These experiments showed beyond question to engineers that high ratios of expansion under these conditions were wasteful rather than economical, on account, as we now know, of the heat losses inside the cylinder from condensation and reevaporation.

But Mr. Dickerson and others who were attempting to force their high expansion schemes in the navy were inventors and advocates but not—in any proper sense—engineers. They continued their controversy with Mr. Isherwood, and by energetic use of the press and by pamphlet publications succeeded in attracting public attention to a subject which few outside of professional circles really understood. In this manner they gradually created a strong public opinion in favor of the "needy inventor" and "agin the government."

It was thus that the public mind was made ready to accept the first apparent evidence of the inefficiency of naval engineers—a disposition already too plainly shown by a majority of the line officers, in their attitude towards the staff and in their determined efforts to prevent the staff officers from receiving any reasonable rank.

That there should have been a feeling of exclusive superiority on the part of many officers of the line, when steam was first introduced in our naval service, was quite natural. Our brilliant naval history was a history of the achievements of the line, and with just pride our officers were wont to look back upon the short but illustrious naval career of our country with a feeling almost of proprietorship. The engineers appointed from civil life had no heroic traditions; their calling was too dirty and prosaic to be immaculate; there was no dilettante in their ranks, and the terms "Greasers" and "Engine Drivers" were not unusual appellations.

Many still living can recall the intense excitement which followed the "Trent" affair, in the opening days of the Civil War. The probability that war with England would follow the capture of the two Confederate Commissioners, Mason and Slidell, by Captain Wilkes, stirred to the utmost depths the patriotism and apprehensions of the North. In that emergency, it will be remembered, the skilful diplomacy of Secretary Seward in his memorable correspondence with Lord John Russell created an opportunity which the personal influence of the Prince Consort turned into an amicable adjustment of the difficulty which had so seriously threatened the peace of both countries.

Although diplomatic and commercial intercourse still continued, the powerful interests and growing sentiment in England in favor of recognition of the Southern Confederacy were more disturbing than ever. The fitting out of the "Alabama," at Liverpool, for her career of ruin and destruction to our commerce, had given us potent cause for resentment against Great Britain, as the "Trent" affair had previously aroused resentment in that nation against ourselves, and the proposition of Louis Napoleon for an armed intervention and a division of our territory had received such consideration by Mr. Gladstone that our people were living in an atmosphere of uncertainty and unrest, when at any moment the spark of war might ignite.

It was at this trying time that Congress passed an act authorizing the construction of six war vessels, to carry an armament of few guns of large caliber and great range, and to be given such power and speed that they might prey upon an enemy's commerce without risk of capture by any man-of-war then afloat.

The urgent necessity to have the vessels in commission and their services available at the earliest possible moment caused the Secretary of the Navy to contract with private parties for the construction of two of the vessels, the other four to be designed and built by the Government.

In view of the controversy above outlined there was an opportunity for a direct trial of the various contentions and a comparison of the relative merits of the engineering skill of civilian establishments with that of the government engineers.

And here it must be explained how seriously deficient the United States then was in facilities for constructing naval vessels. The change from sail power to steam power had just been made. There were abundance of shipyards in the North which could turn out as fine sailing vessels as ever ploughed the seas; but not a shop which had experience or outfit for building marine engines of any size larger than those for the small river steamboats of that day. Naturally, too, there were no engineers in civil life experienced in the design of marine engines.

The Government, too, in its own navy yards was little if any better equipped for marine engine construction, and had of necessity to turn over to private shops most of its work.

The two cruisers whose design was entrusted to private parties were the "Idaho" and the "Madawaska." The contract for the "Idaho" was taken by Mr. Paul L. Forbes, and he selected Mr. E. N. Dickerson, who had in the meantime become a consulting engineer as well as a lawyer, to design and supervise the construction of her engines. To the well known inventor Mr. John Ericsson fell the lot of building the engines for the "Madawaska." These two vessels, according to the terms of the contracts, were to be finished within 18 months and to attain a speed of not less than 15 knots an hour.

The four remaining cruisers, the "Wampanoag," "Ammonoosac," "Neshaminy" and "Pompanoosuc," were to be built by the department upon plans prepared by Mr. Isherwood, and the engines for all of them were designed by him as Engineer in Chief.

That the claims of the two eminent engineers, Mr. Ericsson and Mr. Isherwood, should have a perfectly even test and should be tried under precisely the same conditions, the hulls of the "Wampanoag" and "Madawaska" were built alongside of each other, on exactly the same lines, by Naval Constructor Delano at the Brooklyn Navy Yard. Upon Mr. Henry Steers, then in the height of his career as a builder of fast sailing vessels, fell the responsibility of building the hull of the "Idaho."

Everywhere was haste to meet a crisis in our relations with England which might at any moment find us unprepared. At no time during the Civil War was a more feverish anxiety in the minds of the people or a greater apprehension as to the result of the difficulties in which the cause of the North had become involved, and a deep interest centered in these six cruisers, whose large steam and sailing radius and great speed was looked upon hopefully as an offset to our naval inferiority in other respects.

Fortunately, as time passed, the relations with England assumed a better aspect and the immediate crisis passed for which these vessels were designed.

Further, and still more important, the pressing needs of the Army took precedence of those of the Navy. The shops of the North were strained to their utmost to meet the demands of the Army, for river steamers and transport service and all the machinery and munitions of warfare. The demand for men for the ranks prevented increase in the working force of shops and ship yards. Thus it came about that these six fast cruisers, designed in such haste in the early days of the war, were not finally completed until after its close.

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*Alpine, N. J.

The "Madawaska," equipped with Ericsson's engines, was the first ship eventually completed, but it was not until the latter part of 1866 that she was reported ready for service. In January, 1867, the first test of her engines was made. On her sea trial which followed; under favorable weather conditions, she sustained a speed of 1[illegible] knots for four hours, and during that time reached the maximum of 16 knots; but her average speed for the 41 hours of her trial was only 1[illegible].5 knots, more than 2 knots below the contract requirement. Still the Government promptly accepted the vessel and laid her up in ordinary. In 1871 her name was changed to the "Tennessee," one-half of her boilers were taken out, an additional deck built, and she was converted into a gun-deck frigate. Her first cruise was to San Domingo, where she took a Congressional committee, of which Senator Ben Wade was chairman, and great anxiety was felt for their safety because of the long time she consumed in making the voyage. On her return her engines were taken out, new ones built by Mr. John Roach put in her, and when at last she had been reconstructed into an old-time frigate she had cost the Government $3,800,000.

The "Idaho's" trial, which was next to come, was deeply humiliating to those who had pinned their faith to the high-expansion theories of Mr. Dickerson. The official records showed an average speed of only 8.27 knots an hour for the 24 hours of her steam trial. Her engines were therefore taken out, under orders from the Examining Board; she was converted into a sailing vessel and ordered to Japan, to lie as a store ship in Yokohama harbor.*

The delays in the construction of the four cruisers built from Commodore Isherwood's designs were even greater than those on the "Idaho" and "Madawaska," due, as before explained, to the pressure of other work on the contract shops; and after the close of the war, to the neglect of all naval matters by the public and by Congress.

Eventually, however, the long delay came to public attention and became especially noticeable after the failure of the engines of the "Idaho" and "Madawaska." People began to look upon this long wait as evidence of distrust by the Department in the success of its own work and of fear that failure likewise awaited the trial of its own engines.

This belief resulted in severe criticism of Chief Engineer Isherwood and was effectively encouraged by the line officers in their desire to keep down the staff. When in the latter part of November, 1867, the "Wampanoag's" engines were at last reported ready for steam trial, an unusual interest was taken in the event and the result was awaited with conflicting hopes and expectations. When this trial was stopped by the after-journal on the shaft becoming hot, belief in the incompetency of the naval engineers had become fixed as a certainty in the public mind, which was much more ready to condemn failure than to approve success.

Under these conditions the "Wampanoag" lay tied to the wharf at the New York navy yard for nearly four months, while every effort was made to make that obstinate journal run. No expedient tried could remedy the difficulty, and the daily telegram to Mr. Isherwood in Washington from Chief Engineer John S. Albert, who had been appointed by the Secretary of the Navy to superintend the construction of the engines of the "Wampanoag" and the "Ammonoosac," carried the same unwelcome message, "'Wampanoag's' journal still hot." This was an opportunity not to be lost by the maliciously inclined, and it was soon rumored that this great cruiser's career would end as it had begun, tied to the wharf where she lay, in the unworthy occupation of filling in the cob-dock with ashes.

It should be here explained that the trouble with this journal was due to no fault in the design. A good idea of the limited shop facilities then available may be found from the fact that the Novelty Iron Works of New York, which built the engines of the "Wampanoag" had no lathe large enough to turn the shaft as a whole, and it had to be turned piece-meal in makeshift fashion. That the journal was not true and ran hot in its bearing was therefore nothing at all strange.

Pending in Congress at that time was a bill to prevent proper recognition of the services of the staff by denying them the naval rank for which they had so long struggled.

Admiral Porter, then in charge at the Naval Academy at Annapolis, was one of the strongest and most determined opponents of what was termed the "pretensions of the staff," and a powerful combination of interests was active to prevent any action by Congress favorable to their claims. To illustrate the warmth of the attacks and the intensely hostile feeling which prevailed against the Engineering Department of the Navy, the following extract is taken from an address of Mr. E. N. Dickerson:

> I have read the testimony of Isherwood and appreciate its effect; and when I entered this room, there stood upon that stand one of the cubs of this lion—an engine driver from the navy yard—sent here to discover whatever fragments had been left from the destructive meal of the day before. He was a gorgeous creature as he stood before me, resplendent in gold lace, his delicate white hands unsullied by vile grease and unhardened by vulgar toil; his magnificent apparel shedding an effulgence of glory around him, in which the rings of Saturn encircling his arms vied with the splendors of Mars all over his body for supremacy. There he stood as—
>
> "The Assyrian came down like a wolf on the fold,
> And his cohorts were gleaming in purple and gold."
>
> I never behold one of these magnificent visions without thinking how striking is the resemblance between an engine driver of the United States Navy of this day and the lilies of the valley. Not perhaps from any especial modesty which they have in common, but, like them, they toil not, neither do they spin; but I say unto you, that Solomon in all his glory was not arrayed like one of these.

In a prominent service journal the following criticism of Mr. Isherwood appeared in its leading editorial only two weeks before the final successful sea trial of the "Wampanoag":

> We speak very severely of Mr. Isherwood's practice. But we have done so from mature and profound conviction that he is ruining the Navy by his untenable steam delusions. If we have utterly condemned his theories, we have done so only upon a basis of irrefragable facts—facts which we have set forth in array before that gentleman and before our readers in an elaborate series of articles, and to which, despite this bold challenge of refutation, never has been even attempted a reply. We are free to say that there is no such monument of mechanical incapacity as the steam machinery of the "Wampanoag" class to be found in the annals of marine engineering. We find as a result of this short-sighted restriction, a man presiding over the Engineering Bureau who would not be allowed to plan, on the principles he employs for one whole new screw fleet, a hundred dollars' worth of machinery in any private establishment in the country.

The defect in the "Wampanoag's" engine which was so difficult to overcome, was tangible evidence which was diligently brought to the notice of every Senator and Representative in Congress of the inefficiency of the Bureau of Steam Engineering of the United States Navy. Here was an engine designed by the Engineer-in-Chief—built under the supervision of Assistants chosen by himself—an engine built under conditions which secured every facility to insure success—which, when at last completed and steam applied, could not be made to run!

At this juncture Mr. Sidney Albert, Assistant Engineer in the Navy, younger brother of Chief Engineer John S. Albert, of the "Wampanoag," returned home from the European station. While in the Mediterranean he had an experience in Genoa with olive oil as a lubricant which led him to recommend it as a sure cure for a hot journal—as he expressed it, "Olive oil churned up with a jet of salt water is like 'slip and go down,' and if anything in this wide world will make that journal run without getting hot, that will do the trick."

The next day Chief Engineer of the Yard Danby was surprised with an unusual requisition for a barrel of olive oil and was greatly amused at the idea of putting salad oil on an engine. Within twenty-four hours, however, the with other engineers of the yard were rejoicing over a message which, changed from the monotonous announcement of "journal still hot," to an entirely different tune, carried to Mr. Isherwood at Washington the welcome news,

> "Wampanoag" ready for her sea trial.
> John S. Albert.

This message eased a strain which was becoming too intense to bear and called a sudden halt to the attacks on the Engineer Corps.

Under the command of Capt. J. W. A. Nicholson, familiarly known as "War Horse" Nicholson, the "Wampanoag" steamed down to Fortress Monroe, where she took on a board of officers ordered by the Navy Department to accompany her and report the results of her trip. On Feb. 12, in cold, stormy weather and a rough sea, she ran down the coast as far as Charleston, returning to the port of New York.

The official reports of this remarkable sea trial, which were a source of relief and rejoicing to many, also caused pain and astonishment to a great many more who had the mortification of seeing all their theories and contentions swept away; and conspicuous among the latter were a number of the engineering journals of England, who, unable or at least unwilling to come down gracefully, had the bad taste to question the truthfulness of the official reports.

When it is considered that the "Wampanoag" was a full-rigged sloop of war, that her trial was in a rough sea and a blow, her phenomenal record is all the more worthy. It was by the merest accident on her return trip that a comparison was made possible between the relative speed of the commercial marine and this new naval steamer.

Off the Delaware capes the "Wampanoag," going at the rate of about 16 knots, ran into a fog bank and Captain Nicholson and Chief Engineer Albert determined to let her go until ordered by the official Naval Board to reduce speed. As she swiftly steamed along, a growing anxiety became apparent and inquiries more frequent as to the number of revolutions the screw was making and the number of knots that were being reeled off, until at last, notwithstanding Captain Nicholson's assurance "if they struck anything they would go clean through it," the Board ordered her to be slowed down.

While running slowly back to New York, the fog lifted and the smoke of a transatlantic steamer was seen on the northern horizon about equidistant from the port to which both were speeding. The pilot made out the "Russia," Captain Judkins—the flagship of the Cunard line. Giving the "Wampanoag" full steam ahead, she ran the "Russia" some distance astern and crossing the bar several miles in the lead ran up to the city and, anchoring off the Battery, reported the "Russia" off the bar.

The surprise and astonishment in steamship circles around Bowling Green, when it became known that a United States man-of-war had reported the "Russia" below, can well be imagined. When the "Russia," having been detained down the bay by the fog settling down, came up the next day and steaming by the "Wampanoag" as she lay at anchor rounded into her berth at Jersey City, her passengers sent a round-robin to Captain Nicholson asking the privilege of visiting the vessel which had so unceremoniously shown them a clean pair of heels.

At that time the two fastest transatlantic liners competing for the championship were the "Ville de Paris" and the "City of Paris," and each had made a westerly trip at an average of about 14½ knots, though this was considerably more than the general average of either—in fact 14½ knots was an unusual speed for the fastest Atlantic greyhounds of those days.

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*With a hull faultless in model the "Idaho" under sail was destined to still occupy for a brief period a place in the American Navy. On her voyage to Japan she showed such remarkable speed and such admirable sailing qualities that the Department decided to use her in more worthy capacity than a store ship. On Sept. 20, 1869, the "Idaho," under orders to return home, started on her voyage by way of Hong-Kong under pleasant skies and favoring winds, but the next day the barometer began to fall and by sunset this beautiful but unfortunate vessel was in the midst of the most awful typhoon that a ship has ever survived, the barometer reaching the almost unprecedented reading of 27.62. When the storm passed, "by one of those strange mercies of the elements," she was still afloat, a complete wreck, and her crew, miraculously saved, laboriously and slowly worked back to the port from which they had sailed under pleasant auspices and with such buoyant anticipations of home.

Before the loss of this superb vessel the United States Navy had the fastest ships under sail or under steam that were afloat, for the "Idaho" had logged 14½ knots hour after hour with the wind well ahead and her yards braced almost sharp up, and in one watch of four hours made 64 knots. Her greatest speed was attained while in the Indian Ocean, when "she ran all the log line off the reel, marking 18¾ knots before the sand had entirely run out of the glass, when she was probably making 20 knots through the water."

No event in the steam development of the world exploded more theories and prejudices or uprooted the settled convictions of so many scientific authorities as did the records of the "Wampanoag's" run during her sea trial of 405 knots in 24 hours, her mean average of 16.75 knots for that time, and a maximum of 17.75 knots; which maximum speed, the Board of Engineers reported, "could be easily maintained during a passage across the Atlantic, or for any required service."

If it was the fate of the "Wampanoag" to live too soon before the era which her creation heralded," her wonderful speed secured immediate recognition of the great injustice done the engineers of the Navy and caused pride in a great achievement to take the place of promised failure and disgrace, and a revulsion of feeling set in, which reached Washington in time to prevent the humiliation of the staff.

On every Senator's and Congressman's desk the reports of her trial were placed as soon as printed. The "Wampanoag" had come as a savior at a time most needed. Probably no engineer ever experienced a professional triumph of such magnitude and showed so little elation as did Mr. Isherwood. His problems had worked out as he had intended they should, and whatever may have been his personal satisfaction in his achievement, he was too indifferent to hostile criticism and abuse to rejoice over his opponents. As the originator of the military policy of building these ships, he asserted his ability to give them power enough to be the fastest vessels in the world and by persistent argument convinced the Department of the soundness of the policy of constructing them. That he succeeded in accomplishing, under the most trying and discouraging conditions, everything he proposed, the records on file at the Department are surely his highest testimonials.

It was more than 21 years before the speed of the "Wampanoag" was again reached by any vessel in our Navy, and with all the efforts of the different transatlantic lines to excel in speed and with all the mechanical and engineering skill of two continents striving to work out the problem, it was 13 years before an ocean steamer was produced that could equal her record.

It is a curious fact that the officers of the Navy from civil life, and not those of the Line, were the first to appreciate the great factor of speed in naval warfare and to clearly see the requirements of a new navy in perspective.

Of the "Wampanoag," Captain Nicholson in his report wrote, "I consider the 'Wampanoag' as a ship to be faultless in her model, and as a steamship the fastest in the world," and Mr. Isherwood, replying to an adverse criticism, said, "Nothing she pursued could escape her and nothing she fled from could overtake."

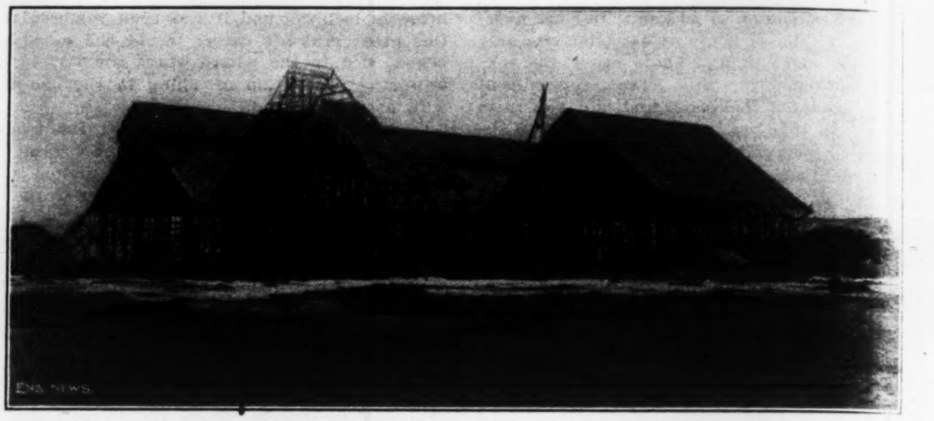
Still the naval mind could not subordinate sail power to that of steam, and with malicious contempt referred to these ships as "coal and engine carriers" and with still greater unction damned them as "runaways." Although ready for active service, these splendid cruisers of the "Wampanoag" class were doomed to lie at the dock, like great Goliaths, securely tied, to rust and rot for 15 years, and were then finally sold as scrap for 2% or 3% of their original cost.

The result of the sea trial of the "Wampanoag" was a well-known event at the time and one of public interest; but the important part played by the barrel of olive oil in contributing to its success has rested in modest obscurity for more than a generation. As the writer is in all probability the only one living who had a personal knowledge of the timely relief it gave, the foregoing account has been written so that this interesting incident in our naval history, although trivial in itself but so far reaching in its important results, may not be lost.

For much valuable information made use of in preparing this article, the writer is indebted to Assistant Engineer Frank M. Bennet's admirable "History of the Steam Navy of the United States."

BAMBOO MAT SHEDS FOR PROTECTING WORKMEN IN ERECTING A WAREHOUSE, CANTON, CHINA.

The accompanying illustration, reproduced from a photograph kindly sent us by Messrs. Purnell & Paget, of Canton, China, shows a bamboo mat shed used to protect workmen against the weather while erecting a warehouse for the Hamburg-American Line at Canton. The bamboo is lashed together, no nails or other metal being used for securing it. Doubtless many of our readers, in their European travels, have seen timber scaffoldings lashed together by means of ropes.



BAMBOO MAT SHEDS FOR PROTECTING WORKMEN IN ERECTING A WAREHOUSE, CANTON, CHINA.

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RAILWAYS AND WATER POLLUTION, WITH SPECIAL REFERENCE TO THE WATER SUPPLY OF SEATTLE.

Little attention has been given as yet to the relation between railway construction and operation and the purity of public water supplies. The December number of the "Journal of the New England Water Works Association" contains some 60 pages on this subject, consisting of an address by Prof. William T. Sedgwick, delivered before the Association last September, supplemented by a number of appendices. A large part of the address and all of the appendices relate to the possible pollution of the water supply of Seattle, Wash., by the proposed extension of the main line of the Chicago, Milwaukee & St. Paul Railway through the Cedar River drainage area, from which the water supply of Seattle is drawn. The proposed railway is to extend through the drainage area for eleven miles, for the most part close to Cedar River above the water supply intake. An ordinance granting the railway company a 100-ft. right-of-way for the purpose stated was passed by the City Council of Seattle on May 21, 1906, and approved by the Mayor on June 5. Portions of the ordinance, with Professor Sedgwick's comments on them, as given in the address mentioned above, follow:

ORDINANCE NO. 13,836.

An ordinance granting to the Chicago, Milwaukee & St. Paul Railway Co. of Washington, its successors and assigns, a right-of-way 100 ft. in width for the location, construction, maintenance, and operation of a railroad across and through lands owned by the City of Seattle, in the County of King, State of Washington, and authorizing the execution and delivery of a conveyance of such right-of-way. Be it ordained by the City of Seattle as follows:

Sec. 1. That there be, and hereby is, granted to the Chicago, Milwaukee & St. Paul Railway Co. of Washington, its successors and assigns, a right-of-way, in perpetuity, for the location, construction, maintenance, and operation of a railroad upon, across, and through the lands owned by the City of Seattle, in the County of King, State of Washington, one hundred (100) feet in width, being fifty (50) feet of such width on each side of the center line of the railroad of said county as located and staked out upon the ground, which lands are described as follows, * * * *:

Provided, however, that nothing in this ordinance contained shall be construed to grant any right to said railway company, its successors or assigns, to occupy or use the bed of the stream of Cedar River, or any portion thereof, or any of its tributaries, except so far as herein authorized for the purpose of constructing and maintaining bridges across said river or for the purpose of constructing and maintaining embankments for the roadbed of said railroad.

Sec. 2. The grant of the right-of-way herein contained is upon and subject to the following conditions, to wit:

(1) Said grantee shall begin the construction of its railroad upon the right-of-way herein granted within one year.

(2) No station shall be established or mai d by said railway company, its successors or assign ween the city intake and the easterly terminus of ight-of-way herein granted without the consent of City of Seattle first having been granted by ordinan

(3) While the said right-of-way is being cl and prepared, and during the construction of said road thereon, the camps or living quarters of the men aged in such work, and the accommodations for any nals employed thereon, shall be located and main d at such distance from said Cedar River, in good tary condition, as shall be approved by said City of ttle.

(4) The grantee, its successors and assigns, l locate the living quarters of any and all employees aged in the care and maintenance of the railroad constructed upon the right-of-way herein granted, or in the operation and maintenance of any side or passing tracks, water tanks, telegraph or block signal stations or towers, or other appliances, constructed and maintained upon said right-of-way, at such distance from Cedar River as shall be approved by the City of Seattle, and shall maintain such living quarters in good sanitary condition.

(5) The said City of Seattle may employ an inspector to patrol or inspect the work of construction of the said railroad upon said right-of-way for the purpose of ascertaining whether said work is being prosecuted in accordance with the conditions herein contained, and said grantee agrees to pay the cost of such inspection.

Then follows a location of the bridges to be built, with a provision at the end as follows:

All bridges constructed upon said right-of-way across any creeks or streams intersecting said right-of-way shall be solid-decked structures, and all bridges, trestles, and approaches shall be constructed and maintained so as to prevent any foreign matter from dropping from engines, cars, or trains passing over the same into Cedar River or into the creek or streams running into said river.

(7) Said grantee, its successors and assigns, shall not, during the construction of said railroad, or thereafter in the maintenance or operation thereof, place, throw or deposit or permit the placing, throwing, or depositing in said Cedar River, or in any creeks or streams running into said river, or upon any ground adjacent to said river, any offensive or deleterious matter which may cause the pollution of the waters of said streams, and said grantee, its successors and assigns, shall at all times maintain the right-of-way herein granted, and the railroad constructed thereon, in such manner as not to cause any pollution to said stream.

Further on is a section in which it is provided that if the railroad, in order to avoid curves of more than 3 degrees, finds it necessary to go into the river.

Embankments required for the proper support of said roadbed may be extended into the bed of the stream, provided that such embankments shall be built of such material and in such manner as to avoid pollution of the waters of said river, and so as to prevent the escape or passage of offensive matter from or over said embankments into the said river.

Finally, there is a section not only authorizing the mayor and comptroller, but directing them,

upon the taking effect of this ordinance, to execute and deliver to said grantee a deed conveying in perpetuity . . . the right-of-way herein granted . . . for the construction, maintenance, and operation of said railroad'. . .

Before the Mayor had signed the deeds for the right-of-way, as provided in the ordinance, an agitation against the extension of the railway through the drainage area began, and attained such proportions and strength as to lead the railway company to engage a number of experts to report upon the subject. Later the matter was referred to a committee representing the various interests involved, and still later Mr. John R. Freeman, M. Am. Soc. C. E., who happened to be in Seattle, made a report in behalf of the State Board of Health.

The report made by Mr. John W. Alvord, M. Am. Soc. C. E., of Chicago, one of the men first engaged by the railroad company, was abstracted at some length in our issue of Aug. 30, 1906. Following this report, we gave an abstract of the report of the commission to whom the whole subject was referred for settlement. The commission consisted of Dr. A. C. Abbott, Professor of Hygiene in the University of Pennsylvania and Health Officer of the City of Philadelphia, representing the City of Seattle; Dr. Charles Ha[illegible]on, Professor of Hygiene in Harvard University and Secretary of the Massachusetts State Board of Health, representing the King County Medical Society (Seattle); and Professor Sedgwick, representing the railroad company. Some of the ideas advanced by Mr. Freeman in his report are given below, but before proceeding with them we will quote a portion of Professor Sedgwick's address, dealing with some of the general aspects of railway sanitation, as follows:

THE WATER SUPPLY AND SEWERAGE OF RAILWAY TRAINS.

As long ago as 1899 I urged the members of the New England Railroad Club to devise some better method of disposal of excrements than that now customary on railroad trains. I dwelt also at much length upon the need of improved water supply arrangements—a subject which still deserves the closest attention. Through cars are often run great distances, passing through various cities and towns en route, and receiving from time to time fresh supplies of water. It may, therefore, easily happen that if any one of these supplies is impure, the water tanks shall become contaminated, and persons traveling in the car, or even joining it at stations which have excellent water supplies, may be exposed to the danger of contracting disease. I have myself had offered to me in a dining car in New England a clayey water which had obviously been taken into the water tanks on the previous day when the water supply of the car had been replenished in Washington, D. C. To a very much less extent travelers may be exposed to similar danger from contaminated ice.

The importance of the distribution of contaminated water from large centers, such as Chicago, Cleveland, Pittsburg, and Washington, having now or having recently had polluted water supplies, is very great, and well deserves the closest attention of epidemiologists, especially those who have been puzzled to explain the excess of typhoid fever in the United States over that in other civilized countries, such as England and Germany. At the same time the railroad companies can hardly be blamed for filling their water tanks from any accessible water supplies which are locally deemed good enough for the public at large.

There still remains, however, a feature of the method used for water supply within the cars themselves which calls for serious criticism, and that is the use of the common drinking cup, which here, as always, is a well-known sanitary abomination. A dozen or more years ago it was the almost universal custom on American railways for one of the brakemen to carry through the cars a tin can to which were attached a couple of removable cups or glasses. These were used in turn by thirsty passengers who remained in their seats, the glasses being filled for them by the brakeman as he paused for the purpose. This practice is now largely done away, and in its place a single cup or glass is kept under a fixed water tank, from which a jet of water can readily be drawn into the cup or tumbler, which is thus intended to serve the needs of the population of an entire car. Any one who thinks that this plan of meeting the water-supply needs of a large number of people of all sorts is either attractive or wholesome needs only to sit near the water tank of a crowded excursion train on some hot summer day, especially if the car is filled with mothers and young children, in order to be quickly convinced that a reform is here urgently demanded. Few things are more trying to a sanitarian than to observe a series of thirsty passengers of all degrees of cleanness and uncleanness applying their lips in succession to one and the same tumbler, which is seldom, if ever, even rinsed between times. Wholly apart from the question of the quality of the water furnished, the opportunity here provided for the exchange of disease germs must be apparent to any one, and I need not further enlarge upon a custom which is both familiar and disgusting.

A remedy might easily be found by having the faucet of the water tank bent upward and provided with a special orifice so that a small jet should rise for an inch or so above its tip, thereby furnishing "sanitary fountains" similar to those which, in increasing numbers, are being provided in parks, playgrounds, gymnasia, schools, and other places where many persons must, of necessity, drink from a common supply. Travelers should also be encouraged to bring with them on railways their own private drinking cups.

Criticisms have frequently been made of the filling of the water tanks and the handling of broken pieces of ice for the tanks by employees whose hands are far from clean, and it must be admitted that the whole matter of the water supply and ice supply of passenger trains frequently leaves much to be desired in the way of sanitary improvement.

As for the sewerage of trains, within a few years, and from motives of mere decency, the custom has become general of locking the closets for the purpose of excluding passengers from them on trains approaching or standing at important stations, a practice which, as will be explained beyond, while certainly contributing to the cleanness of the station platforms, is decidedly objectionable on hygienic grounds. Only in very rare cases, however, so far as I am aware, are the closets of the numerous passenger trains on a great trunk line kept locked for several miles while approaching and after leaving a station, not for decency's sake but in order to protect a public water supply.

Near the city of New Haven, Conn., many travelers have noticed that the closets on the Pullman and other cars going east are kept locked after leaving that city until Branford, nine miles away, has been passed. Going west, the closets are locked as the trains approach Branford and are not unlocked until after leaving the New Haven station. I am informed that the reason for this practice is that some two or three years ago inspectors employed by the New Haven Water Co., while patrolling the Lake Saltonstall watershed near Branford, observed and reported the presence of fecal matter on the rails or roadbed very near the intake of the Lake Saltonstall supply of the water company, which company thereupon complained to the railway officials, who issued an order requiring all closets to be kept locked on trains traveling between Branford and New Haven. I am also informed that a similar rule requires the locking of all closets on trains on the Northampton Division of the same road between New Haven and Cheshire, a distance of 15½ miles, for the better protection of another supply of the New Haven Water Co., the Lake Whitney supply.

I have been unable, however, to find that any similar precautions are taken in regard to freight trainmen. On the contrary, inquiries have shown that on our eastern railroads the freight brakemen and trainmen have to get along the best way they can in answering the calls of nature. I am told that in the west there is generally a closet in the caboose for the use of these men, but that near Boston the crews of freight trains either make use of empty box cars, which they defile at their convenience or necessity, or of the coal pile in the tender; or that, when taken hurriedly, they even use as a seat the couplings or bars connecting the cars—obviously an uncomfortable and dangerous practice, especially when the train is moving rapidly. All of these facts further illustrate the crudity and primitive character of the sanitary arrangements of our American railway trains, for, obviously, no occasional locking of closets on passenger trains will ever be more than a partial and very superficial remedy of the present crying evils.

The New Haven case is the only one of which I have heard in which definite fecal pollution of the rails was observed near a water supply, or in which any similar observation led to an immediate attempt at reform. I have recently learned, however, from Mr. R. W. Pratt, Chief Engineer of the State Board of Health of Ohio, of a case, not exactly identical with the New Haven case, but so nearly in the same category that I have asked him to give me a statement of it, which he has kindly done, and which he permits me to quote here.

> The village of Plymouth, Ohio, has, until recently, used as a partial source of water supply a small tributary of the Huron River. Water was taken at a point a short distance southeast of the village, immediately north of, and very near, the Northern Ohio Railroad bridge, which spans this tributary stream or creek. Two hundred feet west of the creek, and 20 or 30 ft. above it, adjacent to the railroad, is a water tank used for railroad purposes. A small gully runs from the tank to the stream, which it enters just above the intake.
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> In June, 1905, during an inspection of the public water supply by a representative of the Ohio State Board of Health, an east-bound train, composed of freight cars, cattle cars, and one passenger coach, stopped at the tank to take water. After filling the locomotive tender, the train slowly passed on to such a point that the forward cattle car was brought directly opposite the tank. The day being hot, the animals were badly in need of water. In order to water them, a brakeman swung the spout of the water tank directly into the car, turned on the water and signaled for the locomotive to move slowly forward. By this procedure the cattle and hogs in the several cars were given a generous shower bath, while much of the accumulated filth in the bottom of the cars was flushed out into the gully by the side of the track, through which it flowed rapidly down to the creek, quickly entering the latter at a point not more than 50 ft. above the intake of the Plymouth water supply.
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> Inquiry showed that this was a common practice on the part of the railroad men during warm weather. It should be added, however, that the railroad officials, when the matter was brought to their attention, agreed to see that the practice was discontinued; and that the village has recently taken steps to procure a sufficient water supply from other sources, so that the use of the creek water will not be necessary in the future.

This case seems to me to be a very important contribution to the literature on this subject, which at best is but scanty, for I may say parenthetically that I have examined English and German authorities and have found nothing of any consequence in them on this subject. One would, perhaps, not expect to find much in such works, because foreigners, as a rule, use closets at stations, leaving the trains, when necessary, for that purpose. It is, generally speaking, only on the fastest trains that closets are provided, and from a German work on railway hygiene, published in 1904, it appears that the discharge pipes from the closets of German express trains discharge their droppings upon the roadbed precisely as ours do.

Finally, quite apart from the matter of sewage disposal, let us consider briefly the hygienic aspect of locked closets on railways. In the first place, although it is true that our commission recommended the locking of the closets while trains were going through the Seattle watershed, we did not depend upon such locking as an entire safeguard, and I do not believe that locking ever will be a complete safeguard. There are times, when people are ill, when they simply must get access to the closets. There are times when persons so imperatively require to get into these closets that they will tip the porter heavily, or do almost anything, in order to obtain admittance. And they ought to obtain entrance. It is a hardship, and worse, not to allow access to the closets, the locking of which must be pronounced, once and for all, an imperfect, crude, and, not infrequently, an absolutely barbarous device. The practice is crude and unhygienic, even in its least objectionable form of locking the closets only while the train halts at stations. For any longer period, as for example, while trains are covering the distance from New Haven to Cheshire or New Haven to Branford or vice versa, it is much worse.

Moreover, the practice is not only barbarous and unhygienic, it is often ineffective. How is anybody going to be driven out of a closet at the right time if he is already in it before the train arrives at New Haven going east, or at Branford going west? I have myself, while observing the actual working of this regulation, been informed by a porter as we passed by the New Haven intake near Branford that he could not lock a closet as "there is somebody in it." The regulation is clearly ineffective and unworthy of modern industrial organization. It must be done away with, and that at the earliest possible moment.

As to the dropping of the excreta through the discharge pipe upon the roadbed, this, also, is a crude, unsatisfactory, and unsanitary way of disposing of excreta on trains. At best it necessarily soils the track and the trucks for the section hands and others to walk or to work upon; it sometimes endangers public supplies of water; it always pollutes the air, and under some circumstances, by being carried by section laborers or others on their hands to their homes, endangers persons not immediately in contact with the roadbed or rolling stock.

But, it will be asked, what can be done about the matter? The answer is that the time has come when we must insist that if a railroad company finds it practicable to carry large iron tanks under passenger cars for gas or for refrigerator purposes, it can and must also carry there an iron tank for sewage. If for any reason this is impracticable, earth closets with pails frequently changed may be used. Railroads must somehow cease distributing fecal and urinary matters all along their lines. The closets ought not to be shut up, either at stations or anywhere else, and then the all-important personal hygienic requirements would be met. The sewage tanks or pails could be emptied at selected places, either at the end of the run or, on long runs, at principal stations, precisely as water and gas are now taken into special tanks at principal stations. Of course there would have to be disinfection from time to time, and some trouble would have to be taken to see that the sewage tanks were kept clean and free from smells, but this could be done and ought to be done. At any rate, something different from the present crude, disgusting, and dangerous practice must be devised. And where railroads run over or very near water supplies, as they often do and often must, if common decency and the comfort of the men are not enough to secure it, some provision must also be required for the convenience of freight trainmen. Upon wrecking trains and repair trains it would be easy enough to carry a portable closet, or a fixed privy with earth closet beneath, so that all excrements should later be carried off from the watershed and deposited at a distance.

I am aware, of course, that tanks underneath the cars would, in winter, be exposed to freezing, and that special pains would have to be taken to prevent this. It will not be easy, of course, to get rid of the excreta in a decent and scientific way, as it is simply to let them drop down through a hole in the floor; but we have got through dropping excreta in that way in our houses and hotels, and we must stop doing it in our traveling houses or hotels, that is, in our passenger cars. Water-works authorities, especially, must insist that whenever a railroad passes over a watershed it shall be subject to regulations regarding the discharge of excreta not less stringent than those to which would be applied to an hotel or other place of public resort situated on the same watershed.

MR. FREEMAN'S REPORT.

In opening his report, which was dated Aug. 20, 1906, Mr. Freeman states as his belief that the railway might be safely extended through the drainage area without endangering the water supply of Seattle, provided the construction camps were rigorously cared for, the railroad location moved back from the river at certain points, and special pains be taken in the design of railroad bridges, culverts, etc., and in the operation of trains while passing through the drainage area.

Mr. Freeman considered in some detail the present source of supply at Seattle and the possibility of extending the supply main from the present small intake reservoir to Cedar River, up the river and along the proposed line of railway to Cedar Lake, thus eliminating the question of pollution of the water supply. He concluded that such an extension was not feasible, as it would cut off a large and valuable part of the drainage area.

In constructing the railroad, Mr. Freeman suggested that a sand or gravel dike, at least 3 ft. high by 4 ft. wide on top, be built between the roadbed and the river at all places where the railway is on an embankment, but that so far as possible the roadbed should be built in cut. He also suggested that in wet ground the ditches be given an extra depth of 3 ft. or more and a width of at least 2 ft., and that a vitrified drain pipe, 6 ins. or more in diameter, be laid, covered with at least 1 ft. of gravel, and this construction extended into dry porous gravel, so that the water thus collected might "filter away through a safe distance of not too coarse earth before reaching the river."

Various other suggestions were made by Mr. Freeman, such as the location of a necessary siding at a point as remote as possible from the river, the division of sections so that only one section gang should be located in the drainage area, and in general the exclusion, so far as possible, of all sources of pollution from the drainage area, and the throwing of safeguards around such sources of pollution as could not be excluded.

Instead of tight deck bridges of steel, as provided in the ordinance, Mr. Freeman recommended for the two crossings over Cedar River and the one crossing over Taylor Creek reinforced concrete arch bridges, with the top of the arches, say, at least 2 ft. below the bottom of the ballast and with the space over the arch filled with moderately coarse porous sand, such as will afford good filtration. The side parapets should be carried up 4 ft. above the rail and extended for at least 50 ft. into the bank beyond the high-water line. The smaller creeks and the channels that run strong in time of heavy rains should be the subject of a somewhat similar precaution.

On the control of trains while passing through the drainage area Mr. Freeman expressed himself as follows:

> LOCKING OF PRIVY DOORS ON CARS.
>
> Representatives of the railroad have offered the suggestion that the closet doors could be locked during the times that trains are passing over this 10 or 11 miles of track within the city's watershed, and, perhaps relying on this safeguard as sufficient, had not proposed such extensive structural precautions as I have outlined above.
>
> It appears certain to me, after careful consideration of the known facts regarding typhoid and of the epidemics that have been plainly traced to pollution of a flowing stream, that the safety of the citizens of Seattle demands the more certain, although much more expensive, safeguards herein recommended.
>
> The time of crossing the watershed by a passenger train on an up grade might often be nearly half an hour, and for a freight train the period would be longer, and still longer periods within the watershed are probable in case of detention at the siding waiting for a belated train, or while waiting for a clear track after a wreck.
>
> Persons coming down sick or homeward bound with typhoid or dysentery, or in the early and unrecognized, but infectious, stages may be among the passengers, and it is too much to expect or to require that the door would always be kept locked against urgent need.
>
> Detachable pans under the car closet may possibly, at some future time, come into use, as is now being done on some German railroads, but it is too much to expect that their use could be relied on on all sorts of cars on this ten-mile run between unimportant stations out in the woods. The only safe way is to safeguard the roadbed construction on the theory that closets will often be left unlocked, and then add to the safety by keeping them closed as much as can properly be done.

Investigations for a detention reservoir at the head of the supply main were recommended by Mr. Freeman for the purpose of determining the possibility of securing the advantages of storage, with its consequent elimination of bacteria before the water goes to the consumers.

The foregoing is but a brief abstract of Mr. Freeman's report. Before concluding the abstract we will give, somewhat out of order, an interesting computation made by Mr. Freeman to show the probabilities of typhoid infection of the water supply by passengers on the railway during its course through the drainage area.

> Suppose 1,000 different passengers per day to pass through the Cedar River watershed on the St. Paul road; this is 365,000 per year. Health statistics of Massachusetts (the most complete in the United States) show 1.24 cases of typhoid per 1,000 inhabitants per year. Convalescents and those who have the disease in a mild form, in the first week or two of the disease, may travel. We can at most assume that 450 out of all these 365,000 passengers would have typhoid at some time during the year. Calling the duration of those stages of the disease within which one could travel a month, or one-twelfth of a year, we can expect only 37 persons actually in the infectious stages will travel over the road during the year.
>
> If these have so many as 4 stools per day, the chance is that in the twenty minutes (or one-seventy-second of a day) occupied by ordinary trains passing through the watershed, these 37 cases would produce: Thirty-seven cases multiplied by 4 stools, divided by 72, equals 2 stools per year on track; or the probability is that only 2 discharges per year of excreta from typhoid patients are likely to be dropped on this entire 10 miles of roadbed from passengers.
>
> When we consider that one of the residents of a lumber camp sick with typhoid may have an average of say 2 stools per day (we have figured twice this for the passengers), or say at least 50 stools during his entire illness, this is 25 times as many as we figure out as likely to come from all the passengers in a year.
>
> With 500 persons resident in the watershed, the probability is of only 0.62 cases of typhoid per year among them, and, of course, most of these residents are remote from the stream.
>
> Figuring it in another form, and assuming the domicile in as close proximity to the stream as the track: A resident population of
>
> $$\frac{2\times 1{,}000}{50\times 1.24} = 32$$
>
> persons would produce the same chance of infection that will be presented by 1,000 passengers per day on the trains.

A PENDULUM HAND LEVEL.

The accompanying views show the general construction and the manner of using the Townsend hand level. The instrument consists of a brass tube, each end fitted with an eye-piece provided with peep hole and cross hair, pivoted to a wooden staff and kept in a horizontal position by a heavy metal pendulum. The whole instrument is light in weight, easily adjusted and convenient to use. The staff is of such a length that the cross hairs are just 5 ft. above its lower end. This is a convenient height for most men to use and, furthermore, makes the reading of a level or cross-section rod easy. To adjust the instrument it is only necessary to sight through the peep hole at one end and over the cross hair at the other end and observe some distant stationary object. The instrument is then reversed and, if the line of sight still cuts the object in the same horizontal plane as before, the instrument is in adjustment. If, however, the line of sight does not hit the object at the same level when looking through the opposite end of the telescope, the cross hair is brought, by the thumb screw seen just under the telescope, to halve the distance between the two sights. In this manner the instrument is quickly adjusted.

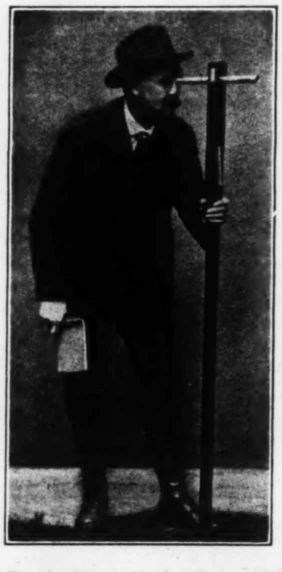

Fig. 1. View Showing the Townsend Pendulum Hand Level in Use.

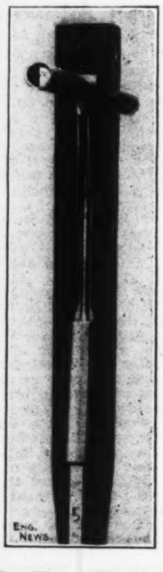

Fig. 2. View Showing Peep Hole, Cross Hair, Adjusting Screw and Arrangement of Telescope and Pendulum in Staff; Townsend Hand Level.

The inventor of this instrument, Mr. [illegible] G. Townsend, of Frostburg, Md., states that he has used it for running grade lines for tramroads, highways and incline planes, and for taking cross-sections, staking out culverts and side ditches and for checking finished work. Also that work can be done much quicker with this instrument than with the ordinary engineer's level, due to time saved in setting up and leveling, and that the results obtained are sufficiently accurate for these classes of work.

TIME EFFECTS IN TIMBER TESTS are being studied by the Forest Service of the U. S. Department of Agriculture. The fact has been previously observed that wooden beams may break ultimately under a continued load less than the load required to rupture them in a short application (as in a testing machine). Thus, wooden beams loaded to 60% of their ordinary breaking load failed after 15 mos. The subject of the relation between strength and stiffness of wood and duration of stress has been very little explored, however, and the Forest Service is now engaged in a systematic investigation, conducted at its timber-testing stations at Yale and Purdue Universities. This investigation will consider not only the effect of long-continued loading, but also (1) the effect of impact, (2) the influence of different speeds of the testing-machine in ordinary testing, and (3) the effect of continued vibration.

To determine the effect of constant load on the strength of wood a special apparatus has been devised by which tests on a series of five beams may be carried on simultaneously. These beams are 2× 2 ins. in section and 36 ins. in length, each under a different load. Their deflections and breaking points are automatically recorded upon a drum which requires 30 days for one rotation. The results of these tests extending over long periods of time may be compared with those on ordinary testing machines, and in this way safe constants, or "dead" loads, for certain timbers may be determined as to breaking strength or limited deflections.

The experiments of the Forest Service show that the effects of impact and gradually applied loads are different, provided that the stress applied by either method is within the elastic limit of the piece under test. For example, a stick will bend twice as far without showing loss of elasticity under impact, or when the load is applied by a blow, as it will under the gradually increasing pressure ordinarily used in testing. These experiments are being extended to determine the general relations between strength under impact and gradual loads.

Bending and compression tests to determine the effect of the speed of application of load on the strength and stiffness of wood have already been made at the Yale laboratory. The bending tests were made at speeds of deflection varying from 2.3 to 0.0045 ins. per min., and required from 20 secs. to six hours for each test. The woods used were longleaf pine, red spruce, and chestnut, both soaked and kiln-dried. The results give a remarkably even curve as an expression of the relation of strength to speed of application of load, and show much greater strength at the higher speeds. A numerical expression of the law, averaging all species, both wet and kiln-dry, gives the following table, which shows the increase in strength with the increase of speed of test:

Minutes to move. crosshead one inch.	Ratios of ultimate strength.	
	Compression.	Bending.
900	100.0	100.0
350	100.8	100.9
150	102.3	107.3
40	106.9	110.1
5	113.8	118.7

The first column, which gives the number of minutes required to move the crosshead of the testing-machine over the space of one inch, is the reciprocal of speed. The second and third columns give the effect of this increase of speed upon compression and bending, respectively, and show that strength increases with speed. The strength at the lowest speed is arbitrarily fixed at 100 as a convenient basis for comparison. The ordinary bending-test speed for small specimens is one-tenth inch per minute, or, reciprocally, 10 minutes are required to move the crosshead one inch.

It is a common belief among polemen that the continual vibrations, to which telephone poles are subjected, take the life out of the wood and render it brash and weak. Nothing is definitely known as to the truth or falsity of this idea. Tests will be undertaken to determine the effect of constant vibration on the strength of wood.

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The fact that the Colorado River has again defied the works of man and resumed its course into the Salton Sink adds to the interest of the remarkable article on the closing of the crevasse which we publish elsewhere in this issue. Five attempts to send the Colorado back to the Gulf of California failed at various stages of their execution, and there had been scarcely time for exchanges of congratulation over the success of the sixth attempt to close the crevasse before the river broke through the levee at one end of the closure works and again poured its swollen volume into the Imperial Valley. Our account of these various attempts is all the more interesting and valuable because it was prepared for us by Mr. H. T. Cory, Assoc. M. Am. Soc. C. E., General Manager and Chief Engineer of the California Development Co. for some months past, including the time of greatest stress.

The relation of the Colorado River to the Salton Sink was described, with the aid of a relief map, in our issue of Feb. 22, 1906. The river, in building itself an elevated bed, formed an inland sea, and this sea, after centuries of exposure in a hot, arid climate, almost disappeared. An immense basin, extending to a depth of some 300 ft. below sea level, was thus formed. The highly alkaline soil resulting from such conditions, combined with the practical absence of rainfall, caused the basin to be known as Death Valley. But the introduction of irrigation works a few years ago brought abundant life out of what was dormancy rather than death, and coincidently a portion of the basin was renamed as the Imperial Valley. The source of this new life soon proved to be itself a menace. The irrigating waters were diverted from the Colorado into the basin through an enlargement of an old overflow channel. The grade of this channel being low, the channel silted up. The crops below being threatened, a short new channel was cut, as stated by Mr. Cory. In the haste of the emergency, no headgates for this new channel were provided. A series of unexpected river floods enlarged the short-cut canal, deepened its grade, thwarted all the belated efforts made to confine the main stream to its bed, and speedily diverted the whole river into the Salton Sea.

In considering the failure of the various attempts to control the river, and particularly the break since closure was effected, it should be remembered that in times of high water the river has frequently overflowed to the Salton Sink, and that there has always been a possibility that the whole river, unaided by man, would go that way. This, however, was hardly likely, since, if we are correctly informed, there were relatively small and widespread overflows at various points, instead of a torrent at one, and always, we presume, a tendency for the river to repair its own breaches, so long as they were minor, by the same process of bank building as provided for it a fixed channel to the Gulf. But once a considerable breach having been made in this built-up bank, composed as it is of material so highly erodible that it may be said to dissolve like sugar, events have proved that a stoppage of the opening is very difficult. The difficulty has been increased by the very rapid fall of the present channel down the slope of the basin, as compared with the fall of the bed of the river.

It might be supposed that the break in the river bank once stopped, the danger of a break would be no greater than it had been before the break of 1904 occurred. At the outset this seems to have been the idea of those engaged in stopping the break, if in the rush and stress of trying to ensure a continuous water supply for the irrigated lands of the Imperial Valley and of protecting the railway tracks of the Southern Pacific they stopped to take a far look ahead. But after a year or more of futile effort to close the breach, during which it rapidly increased in width, it was seen that safety demanded the construction of levees or dikes for some distance above and below the closure works, as stated by Mr. Cory in his article.

From the meager information in hand, it appears that had these dikes been fully completed or heavier at their juncture with the closure works the new break might not have occurred. A reference to Fig. 2 in Mr. Cory's article suggests that a heavy flood in the river after the closure was effected would throw a strong current against the dike at the southwest end of the dam; and this, we understand, is just where the new break is located.

After a two years' unsuccessful struggle with the river it is now evident that only extensive and costly works, designed and built with an eye to all reasonably conceivable future contingencies, will keep the Colorado out of the Imperial Valley and Salton Sea. A large sum of money has already been expended without permanent results, and a far greater sum may be required to ensure final success. Evidently there is a limit to the warrantable expenditure; certainly from private and possibly from public funds. Thus far there are, according to reports, some 10,000 settlers in the Imperial Valley. Their irrigable lands and other property are at stake, as is also a long stretch of main and branch railway of the Southern Pacific. In addition, extensive proposed developments in the basin will be nipped in the bud if the river be not controlled. It is even reported that the whole Yuma irrigation project of the U. S. Reclamation Service, including the Laguna dam, now under construction, may be rendered futile if the Colorado continues to eat its way upstream through its bank. In view of all the facts and possibilities cited, we feel warranted in saying that Mr. Cory's article on the attempts to control the breaks in the bank of the Colorado River is one of commanding interest, both on account of the issues involved and of the intrinsic merit of the article as a description of unparalleled engineering work.

◆

For many years Engineering News has urged safer construction for passenger steamers on inland waters. Again and again we have pointed out that the tinderbox upper works of all our American river steamers, ferry-boats and similar craft plying on inland waters are a menace to the lives of passengers. If proof were needed of our argument, the "Slocum" holocaust and the repeated burning of Fall River Line steamers at their pier has certainly supplied it.

It is therefore with much pleasure that we present in this issue descriptions of a fireproof ferry-boat and a fireproof excursion steamer. We hope and believe that these new vessels mark the beginning of a general reform in marine construction—the substitution of incombustible materials in place of wood.

◆

It is an old custom of Engineering News to open the columns of its Christmas holiday number to occasional articles in a less severely technical vein than our usual table of contents. This may afford the excuse—if excuse be needed—for the paper in this issue describing an incident in our Naval history which well deserves record, because, though insignificant in itself, it had an important influence in the uphill fight for the recognition of the engineer in the Navy.

The incident referred to relates to the professional work of Commodore B. F. Isherwood, who was at the head of the Bureau of Steam Engineering all through the Civil War, and for whose faithful and able discharge of great responsibilities during that trying time the Nation will ever remain indebted.

It is a pleasure to record that Commodore Isherwood is still enjoying good health, although he has reached the advanced age of 86 years. For nearly a quarter of a century he has lived in retirement, enjoying a well-earned rest after the many years of storm and stress during which he carried such heavy burdens. His work for the development of steam engineering is a part of the history of the profession of which American engineers may well be proud.

◆

The protection of public water supplies from infection by railway employees and passengers has not been given the consideration that the importance of the subject demands. The construction of railways, the maintenance of track, the transportation of freight and passengers (particularly the latter), each and all afford numerous opportunities for the pollution of public water supplies drawn from streams and lakes crossed or paralleled by railway tracks. Inasmuch as the Far West is not, as a rule, noted for radical advances in health-protective measures, it is gratifying to have the city of Seattle, Wash., contribute the first striking example of the protection of its water supply from railway pollution. The agitation for such protection at Seattle was carried on by the general public and the medical profession and reached such proportions as to cause the Chicago, Milwaukee & St. Paul Railway Co., the King County Medical Society, the city of Seattle and the Washington State Board of Health to summon experts from various parts of the country, even reaching as far East as Boston, Providence and Philadelphia. Some of the reports made were abstracted in our issue of Aug. 30, 1906, and in our present issue we supplement the matter previously published, and also give some remarks by Prof. W. T. Sedgwick, on "The Water Supply and Sewerage of Trains." Our citations from Professor Sedgwick's paper and from Mr. John R. Freeman's report ought to set water-works men thinking and acting. These experts, as did all the others in the case, agree that railway trains passing across or along surface waters used for public supplies may be a serious menace to health, through promiscuous scattering of excretions from "walking," incipient and convalescent typhoid cases; but at the same time, and without belittling these dangers, they strongly and rightly emphasize the dangers from the resident population and from hunters and fishers in even the most sparsely settled water-works drainage areas. Seattle, having secured an almost unlimited mountain drainage area for its water supply, became highly indignant when it found that a transcontinental railway had been given the right to build its line along the banks of the Cedar River for ten miles above its water-works intake. Not even the medical profession realized that lumber and other camps, fishers and hunters were daily polluting Cedar Lake and River without any attempt at control, while unusual safeguards against pollution had been incorporated in the right-of-way ordinance in question. As will be seen from our extract from Professor Sedgwick's address, he was unable to find, last summer, more than one instance of safeguards against public water supply pollution now in force by a railway company. In our abstract of Mr. Alvord's Seattle report (Engineering News, Aug. 30, 1906) there were given some particulars of railway lines traversing the water supply drainage areas of 21 American cities. No statement was made as to whether or not the various water supplies were in any way protected against pollution. We should be surprised if some attempt at protection had not been made in at least two or three cases, besides the New Haven Water Co. instance cited by Professor Sedgwick. The whole subject is well worth further discussion.

◆

With the close of this volume, we announce the withdrawal from the Engineering News Publishing Co. of D. McN. Stauffer, M. Am. Soc. C. E., for 23 years its Vice-President. Mr. Stauffer's connection with Engineering News dates from January, 1883, when he gave up engineering practice to undertake the editorial conduct of Engineering News, and he had sole charge of this department for four years, until in 1887 he divided the responsibility with the late A. M. Wellington, who at that time became connected with the paper.

In later years he relinquished editorial work to others; but he retained his proprietary interest in the publication and took part in the conduct of its affairs until a few months ago.

NEW STANDARDS IN ENGINEERING LITERATURE.

What is the greatest need in engineering literature at the present day? What can be done by engineering journals and engineering societies that will make them of greater value to the profession?

To these questions, we believe, there can be but one answer: The need to-day is for better quality. The quantity is all-sufficient. The working engineer does not need more journals nor more engineering society proceedings, nor does he ask that they be made more bulky. He does ask—and has a right to ask—that his precious time be economized by those who appeal for his attention. He needs the aid of engineering literature; never was practical knowledge in greater demand; but he complains and has a right to complain when the two grains of valuable information he desires to use are hidden in two bushels of chaff. He has no time to "seek all day till he finds them," as Shakespeare puts it. On the contrary, if it takes too much time to find the thing he wants, he must make shift to do without it.

With this as a preface, it has seemed to us appropriate at this time, as the fifty-sixth volume of Engineering News closes, to explain to our readers some of the standards we have set up and are trying to follow in the conduct of this journal. What we have to say is not wholly new. It has been expressed many times in correspondence with contributors and others. But it needs, we are sure, to be understood much more widely. Comparatively few are aware what an entire change has come over the whole field of engineering literature and how urgent is the need that old standards be abolished and new standards be created.

We have said that the working engineer demands quality and not quantity in his technical literature; but we ought first to make it clear that engineering literature is published primarily for the working engineer and not the amateur or the theorist. The writer of a paper for an engineering journal or an engineering society ought to aim, first and foremost, to make his paper practically useful to his professional brethren, and the measure of merit of his paper is the extent to which he succeeds in this.

It should be understood that this standard excludes elementary matter, designed not for the working engineer, but for the student who is preparing himself for professional life. The technical press is not a substitute for standard text-books. Its business is to record and make accessible the information which has not yet reached the text-books, and much of which will never find a place there.

This standard also assigns an inferior place to matter which is merely curious or amusing, or entertaining, or of popular rather than technical interest. Not that such articles should be wholly excluded. A representative journal of the engineering profession ought to have something more in its pages than mere aids to the day's work, something to help the engineer to a larger outlook on the world, for example. Yet while these things may have place, they must rate second to the articles of practical usefulness.

Now what sort of papers are the most useful and what are least useful to the working engineer? Let us answer the last part of this question first: The least useful papers are the articles descriptive of particular engineering works. This class of articles consumes a large proportion of the space in our engineering journals and Society Transactions; and we believe it is this class of articles that is chiefly responsible for the growing habit of leaving these publications to accumulate unread on the shelves and find a final end in the waste basket.

And yet the situation is not generally understood by any means. People still look for descriptions of particular engineering works in the papers for which they subscribe, and think they are really receiving something when page after page is filled with long detailed descriptions of this or that or the other piece of engineering work. We hear it said that multitudinous pages of such matter make a big showing; but we wonder who ever wades through articles of this sort. We imagine they must be read if at all by the younger engineers—too young to know better.

But are, then, such descriptive articles of no use or interest? We do not go so far as to make such a statement. Many descriptive articles are very well worth while. The engineer who desires to keep abreast of the times wants to know about the great and famous engineering works—those which are in the public eye—such as the Panama Canal, the Hudson River tunnels, the electric trains on the New York Central R. R. Not to know about such matters places an engineer at a disadvantage in contact with the public; and he rightly looks to his professional journal for information.

Then there is another class of descriptive articles to which every intelligently conducted engineering journal gives a hearty welcome. If an engineering work involves new problems of design, exceptional difficulties in execution, novel methods of work, by all means let us have a description of them, and the writer of the article must perforce put in enough concerning the whole work to make its novel features clear.

It is not such descriptive articles that we condemn. What we condemn is the meaningless description of one engineering work after another built on standard designs throughout, with perhaps just enough difference here and there to give the semblance of an excuse for foisting it upon the patient reader in the disguise of engineering literature.

It is this sort of descriptive articles that are commonly and properly known as "write-ups." Its production is a factory process and can be done by cheap labor on the piece-work plan. The only essential is that the writer-up must particularly record which firm furnished the boilers, which the engines, which the generators, which the feed-water heaters, which the cement, which the broken stone—no, not the broken stone, for broken stone dealers don't advertise!

It is not necessary to specify in greater detail the sort of descriptive articles to which we refer. They do not deserve to rank as technical literature. Let us give them their proper name and call them trade write-ups. They are produced for commercial purposes solely, and have nothing of professional character about them.

We recall in this connection a remark by Mr. H. G. Stott in opening his paper on "Power Plant Economics," in our issue of Feb. 8 last:

> Three years ago the steam power plant for the generation of electricity had apparently settled down to an almost uniform arrangement of standard apparatus in which one power plant differed from another only in details of construction of engines, generators and auxiliaries.

When the design of power stations or of [illegible] or of any other class of engineering works becomes so standardized, there can be no excuse for loading up engineering journals with articles describing and illustrating more of the same sort, differing only in their geographical location.

In considering this matter of publishing description of engineering works, too, it is of interest to note the enormous change which has occurred in the last forty years. It is hardly so long ago as that since the engineering works of magnitude were so few that it was practicable to have them all described in current engineering literature. The late Geo. S. Morison used to publish a separate monograph for each large bridge which he designed; and in that day, when literature on bridges of any sort was very scarce, they were prized by the profession. But nowadays there are hundreds of large engineering works going on all over the world, and life is too short to read the descriptions of the fiftieth part of them if they were printed.

The idea which we have again and again endeavored to impress upon contributors is: "Don't describe engineering works; but describe the solution of engineering problems." The working engineer in the field or shop or office can seldom copy direct from another engineering work and would often be misled if he attempted to, since different conditions might prevail. He can find help, however, in the solution of the problems before him from studying the solution that others have used for similar problems.

And by engineering problems we do not mean mathematical problems. These have their value and importance; but in the practical everyday work of the engineer, the problem of how to do a particular thing and do it successfully arises forty times as often. Then the commercial problem is one of those most frequently presented. It is not only how work can be done successfully, but how it can be done at least cost, that the engineer has to decide; it is the business of the engineering journal to give him aid on tasks like these.

If the writer for the technical press will put himself in the place of the reader, and try to imagine just what the reader will want to know, he will find his task simplified; particularly so if he is able to gage the wants not of one reader but of a thousand readers who are in search of help in their work.

And this brings us to the need for greater care in the writing and editing and publishing of engineering literature. If a man were to address an audience of a thousand people, he would deem it worth while to take great pains to present his ideas in the best and most attractive shape. He would try to hold the attention of his audience by studying brevity and forcefulness, and would use such graces of diction as his abilities permitted. Is it not worth while to take as great pains when an audience of ten thousand or twenty thousand is addressed through the columns of an engineering journal? Do the writers for engineering journals fully realize their opportunities to address so great a number of their professional brethren through the technical press? Do they realize how much their professional reputation depends, not only on what they say but on how they say it? If a speaker before an audience of a thousand has nothing worth while to say or if he uses such language as to weary his audience, he will lose their attention. So with the writer who has the opportunity of reaching the far larger audience. Can he hold their attention to the thought he wishes to present? Is he willing to take the pains to do this? If he cannot or will not put in the hard work to make his paper clear and forceful and interesting, then a certain proportion of readers who might have followed it to the end will turn over the pages and read something else.

In saying this, however, we are appealing as much for high standards of editorial work as for greater care on the part of contributors. Few engineers have much experience in literary work; and we would not be understood by any means as wishing to discourage the engineer who has something worth saying to the profession but who has little command of language. As we have said above, practical usefulness is the gage by which to rate the value of a technical contribution and it is the editor's business to put the contribution in acceptable literary form when the writer himself is unable to do so.

We may refer here to another matter concerning which we find frequent misunderstanding, viz., the matter of payment for contributions. Speaking, of course, only for the long established practice of this journal, we may state that all original contributions offered exclusively to us and accepted for publication are paid for. Articles rejected are returned to the senders when a return is requested. It should be clearly understood, moreover, that a large proportion of the articles offered have to be returned because of lack of space for their publication. They may have real interest and value notwithstanding, and their return simply means that the editor has something which he considers at the time of greater importance to the reader.

It is, however, wrong to count the money payment for the contribution as the chief return to the writer, particularly if the contribution will rank high when measured by the standard above quoted: its practical value to the working engineer. The engineering profession has grown to such size that it is exceedingly difficult for an engineer to make himself and his abilities known except through the technical press. Moreover, as we said at the outset, the volume of technical literature has so greatly increased that contributions of ordinary grade fail to receive attention from readers. The engineer who wins large returns in professional reputation from his contributions to engineering literature is the one who has something so important to say and who says it so forcibly that even busy men stop to read.

Finally let us lay emphasis in the fact that the engineering literature of the day is in the last analysis, the work of the engineering profession. If it is to be made better and more useful by following out the lines we have indicated, the work must be done by the engineers themselves. The technical journal is a co-operative exchange. If the practicing engineer looks to it for aid in his work, he ought in turn to impart from his own experience for the benefit of other members of the profession. We have written the above in the hope that it might aid those who would thus contribute to the general fund of knowledge to do it in a way that would be of greatest practical benefit.

In closing this year of editorial work, too, we desire to express our sincere appreciation of those who have during the year contributed to these columns. That their work has reached a higher standard and that our pages have thus been rendered more useful to the profession than in any preceding year we are fully confident. For many hearty words of appreciation and congratulation we return sincere thanks; and we rejoice that the largely increased circle of readers and patrons with which this year closes is but an index of the unprecedented prosperity which this holiday season finds prevalent in all branches of engineering work.

LETTERS TO THE EDITOR.

Reinforced Concrete and the Stories of a Drunk and a Newspaper Man.

Sir: A few months ago a bricklayer in his cups told me that the brickmakers, fireproofing tile companies, lime manufacturers and some structural steel companies had placed funds at the disposal of the brick-masons' union to fight reinforced concrete. When he was sober he absolutely denied having made such a statement, so I dismissed it from my mind.

I have charge of some reinforced concrete work at present in a medium-sized city and a few blocks away is a new building just completed, having reinforced concrete columns and floors with partitions of tile and exterior walls of brick. When the forms on the fourth and fifth floors were removed some of the girders and columns moved. On the first floor one of the main columns commenced to bulge and it was fixed by banding it with steel and putting over the outside a thick coat of cement mortar. My inspection of the work leads me to believe the trouble due entirely to defective workmanship in not securing the vertical bars against displacement when pouring the concrete; very light bracing of 2 x 4-in. studding not diagonally braced, many being perceptibly bent; and too early removal of the forms.

The matter of course attracted considerable attention because the workmen were nervous and talked a great deal. By a strange coincidence the trouble manifested itself the day of the Bixby Hotel disaster.

A newspaper man asked me who was trying to discredit reinforced concrete and explained his question as follows: Every day a plain envelope comes to the office of his paper, sealed and stamped with a two-cent stamp. The envelope contains galley proofs of items about failures of reinforced concrete buildings. Every failure, no matter how slight, is mentioned. He said the other newspaper in town receives these items also and a number of bankers and dealers in building materials receive them. The cashier of a leading bank told me he had heard so much lately about failures of reinforced concrete buildings that he was scared to pass on loans for them. Who is mailing the items?

Yours truly,
Ernest McCullough.

Chicago, Ill., Dec. 17, 1906.

◆

Continuity and Cantilever Action in Reinforced Concrete Beams.

Sir: The writer had the pleasure of perusing a letter by Mr. E. P. Goodrich in your issue of Nov. 28, the poignant phase of which was the advancement of cantilever construction for beams. Doubtless the writer does not grasp Mr. Goodrich's idea—but he would appreciate any elucidation along the following lines:

First, cantilever stresses being very much larger than simple beam stresses, more steel is obviously required, the maximum moment being ½Wl as against ⅛Wl. [But in the cantilever of half the span of the simple beam, W and l are each only half as great, so that the two expressions are in fact equal.—Ed.]

Second, the compression area of the beam, being on the under side, derives no assistance from the slab as in the case with simple beams.

Third, the compression fibers being isolated, does not conservative practice require compression steel?

Fourth, what would happen when exposure to fire had disintegrated the outermost fibers of the cantilever beam, the fibers subjected to the maximum stress?

Fifth, is not the placing of reinforcement much more unreliable on the top than on the lower side of the beam? The uncertainty of placing of top bars has led conservative practice to disregard almost entirely the effect of continuity of beam and to consider at the most only $^1/_{10}$ Wl as the moment at the mid-span, whereas continuity would place its value at $^1/_{24}$ Wl, with a maximum over the support of $^1/_{12}$ Wl. The building laws of most of our large cities are explicit on this point, some allowing only ⅛ Wl, in short absolutely ignoring the great gain had by continuity—and the sole reason is the unreliability of placement of the top reinforcing bars.

Finally, where does the economy come in by using the so-called cantilever construction, and how do the advantages claimed offset the disadvantages above mentioned?

An impartial consideration of these points in reference to Mr. Goodrich's letter would be appreciated.

Yours very truly,
Porter H. Franklyn, C. E.
72 Madison St., Chicago, Ill., Dec. 7, 1906.

◆

The Design of Reinforced-Concrete Retaining Walls.

Sir: In relation to the articles published in your issues of Oct. 18 and Nov. 15, by Messrs. Godfrey and Goodrich, on the subject of retaining walls, the writer begs to express his own views on the subject.

Though the writer differs from Mr. Godfrey as to the value of the weight of earth and angle of repose to be taken into consideration in designing retaining walls, he agrees that Mr. Godfrey's approximate method is sufficiently close for ordinary retaining walls. The idea of having the rear part of the base acted upon by forces acting downward only should be followed in the designing of retaining walls, but in Mr. Godfrey's scheme the base extends $\frac{1}{2.4}$ h = 0.42 h behind the curtain, which makes a great amount of excavation. On the other hand, the block of concrete at bottom of curtain could, in the writer's opinion, be used more satisfactorily in extending the base forward, by this means reducing the unit pressure on ground at front edge of the base.

The object of this letter is to determine the conditions for a reinforced-concrete retaining wall of the usual type which would require the smallest amount of excavation and at the same time have the load on rear of base acting downward the full extent of the base behind the curtain.

The determination of the width of the part of the base at rear of curtain (which will be called b) is based upon the wall resisting the sliding tendency by means of friction of the base with the ground, also by resistance of earth at front of curtain. The latter factor may be neglected, as it is small and its neglect in favor of stability.

Let l be the factor of safety required;
ϕ, angle of repose of natural earth;
ϕ', angle of friction of concrete with earth;
h, height of the wall;
b, the rear base unknown;
w, weight of acubic foot of earth.

The above-named condition may be written

$$l\frac{w h^2}{2}\tan^2\frac{90^\circ-\phi}{2}=w h b \tan\phi'$$

hence:

$$b=\frac{\tan^2\frac{90^\circ-\phi}{2}}{2\tan\phi'}l h$$

$$\text{Let }\frac{\tan^2\frac{90^\circ-\phi}{2}}{2\tan\phi'}l=m,\text{ then }b=m h\ldots.(1)$$

The width of the front part of the base (which will be called a) will be obtained by complying with the rule of the mean third (i. e., the center of pressure

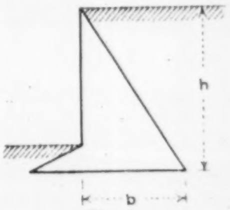


Fig. 1

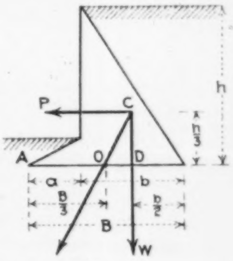


Fig. 2.

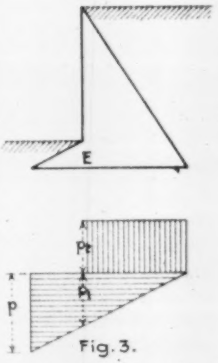


Fig. 3.

must be located inside of the mean third of the total base). The friction of ground on back of wall may be omitted, being very small in value.

Let P = horizontal pressure;
W = weight of wall.

The rule of the mean third may be written $O D \overset{=}{>} \frac{B}{3}$

and taking the limit $O D = \frac{B}{3}$.

It may be seen in Fig. 2 that

$$\frac{P}{W}=\frac{O D}{C D}=\frac{\frac{2}{3}a+\frac{b}{6}}{\frac{h}{3}}=\frac{4a+b}{2h}$$

but

$$P=\frac{w h^2}{2}\tan^2\frac{90^\circ-\phi}{2}$$

$$W=w h b=w l h^2\frac{\tan^2\frac{90-\phi}{2}}{2\tan\phi'}$$

$$\frac{P}{W}=\frac{\tan\phi'}{l}=\frac{8a\tan\phi'+l h\tan^2\frac{1}{2}(90^\circ-\phi)}{4h\tan\phi'}$$

Hence

$$a=\frac{4\tan^2\phi^1-l^2\tan^2\frac{90^\circ-\phi}{2}}{8l\tan\phi'}h$$

Let

$$\frac{4\tan^2\phi^1-l^2\tan^2\frac{90^\circ-\phi}{2}}{8l\tan\phi'}=n;\ldots\ldots(2)$$

then

$$a=n h$$

and the total width of the base will be

$$B=(m+n)\ h.$$

The relation between m and n when the rear base is acted upon exclusively by fores acting downward is

$$P_1=P_2.$$

P_1 being the pressure on ground at point E and P_2 the uniform load per square foot on rear base.

Let P = pressure on ground at front edge of base

$$P_1 = \frac{p\,b}{B} = \frac{\frac{2\,w\,b\,h}{B}\,b}{B} = \frac{2\,w\,b^2\,h}{B^2}$$

$$P_1 = 2\,w\,h\,\frac{m^2}{(m+n)^2}$$

$$P_2 = w\,h$$

then $$w\,h = 2\,w\,h\,\frac{m^2}{(m+n)^2}$$

$$\therefore\ n^2 + 2\,n\,m - m^2 = 0$$

$$n = m\,(\sqrt{2} - 1) = 0.414\ m, \text{ or } \frac{n}{m} = 0.414 \ldots\ldots (3)$$

Let us introduce in equation (3) the values of m and n given in equations (1) and (2).

$$\frac{4\tan^2\phi' - l^2\tan^2\tfrac{1}{2}(90^\circ - \phi)}{8\,l\tan\phi'}\ \frac{2\tan\phi'}{l\tan^2\frac{90^\circ - \phi}{2}} = 0.414$$

$$\frac{\tan^2\phi'}{l^2\tan^2\frac{90^\circ - \phi}{2}} - \frac{1}{4} = 0.414$$

Hence $$l = \frac{\tan\phi'}{0.815\tan\frac{90^\circ - \phi}{2}}$$

If it is admitted, as usual, that the angle of repose of natural earth and angle of friction of earth with concrete are both equal to 35°, then

$$\tan\frac{90^\circ - \phi}{2} = 0.528$$

$$\tan\phi' = 0.70$$

Then a retaining wall designed in accordance with the above formulas will be computed with a factor of safety

$$l = 1.63.$$

This factor of safety is acceptable owing to the fact that some items which add to the stability of the wall have been neglected.

If $l = 1.63$, the values of a and b become respectively 0.134 h and 0.325 h. It will be noticed that the amount of excavation in that case is reduced by 25% over what it would be in Mr. Godfrey's scheme and the total volume of concrete used is practically the same.

The general dimensions of the wall being fixed in accordance with above formulas, the determination of the amount of steel required in each part of the wall may be computed according to the own rules of the engineer.

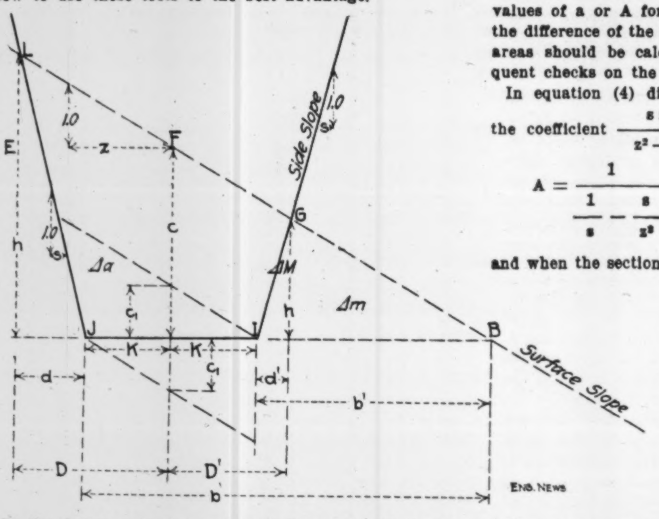
The value given for a in equation (2) is a minimum; it should be used only when the pressure on the ground at the front edge of the base does not exceed the bearing capacity of the earth. Should this occur, a must be increased accordingly.

Respectfully yours,
Henry Massart, C. E.
Glenn Bldg., Baltimore, Md., Nov. 19, 1906.

◆

Formulas for Computing Railway Cross-Section Tables.

Sir: In your issue of Sept. 13 I notice several formulas by different correspondents for calculating the areas of railroad cross-sections in terms of the center height, width of roadbed, side slope of cut (or fill) and surface slope. It appears that all are agreed that it is desirable and useful, where regular surface slopes obtain, to have tables that make it easy to get correct estimates in cubature on preliminary surveys and in comparison of alternate lines on location, so that the important thing is to have these formulas or tools in the most compact and practical form for building these tables, and to know how to use these tools to the best advantage.



In the figure, c is the center height cut or fill (invert the sketch for fill); s:1 is the ratio (horizontal to vertical) of the side slope; z:1 that of the surface slope; K is half the width of the roadbed; h and h' are the side heights; d and d' are the distances out, due to h and h'; c_1 and $-c_1$ are the center heights when the surface slope intersects the roadbed in I and J. Triangle J B L may be called △ M, and its base J B is b; call a area of △ a whose base is 2 K or less; I B = b' is the base of triangle I B G, which will be called △ m. Then the desired area, J I G L is A = △ M − △ m.

It is hardly necessary to go through the steps that give $h = \frac{z\,c + K}{z - s}$ and $b = z\,c + K$. From these two expressions,

$$\triangle M = \frac{(z\,c + K)^2}{2\,(z - s)} \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Since $\frac{c_1}{K}$ or $\frac{-c_1}{K}$ (below grade) $= \frac{1}{z}$, formula (1) is the expression for a for values of c from $\frac{K}{z}$ (cut) to $\frac{-K}{z}$ (fill).

Also $h' = \frac{z\,c - K}{z + s}$ and $b' = z\,c - K$, therefore

$$\triangle m = \frac{(z\,c - K)^2}{2\,(z + s)}$$

and

$$A = \triangle M - \triangle m = \frac{(z\,c + K)^2}{2\,(z - s)} - \frac{(z\,c - K)^2}{2\,(z + s)} \ldots\ldots (2)$$

Formulas (1) and (2) I deduced five or six years ago, but in making tables with them at odd times I found them unwieldy. About two years ago, therefore, I put them in the handier forms,

$$a = \frac{z^2}{2\,(z - s)}\left(c + \frac{K}{z}\right)^2 \ldots\ldots\ldots\ldots (3)$$

and

$$A = \frac{s\,z^2}{z^2 - s^2}\left(c + \frac{K}{s}\right)^2 - \frac{K^2}{s} \ldots\ldots\ldots\ldots (4)$$

It is evident from (4) that except the coefficient of the parenthesis, the equation for all surface slopes can be immediately written for given values of s and K, only the coefficient varying as the surface slope z:1 changes.

To make a particular table, s, K and z are constants, and equations (3) and (4) take the forms

$$a = P\left(c + \frac{K}{z}\right)^2 \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

and

$$A = F\left(c + \frac{K}{s}\right)^2 - Q \ldots\ldots\ldots\ldots\ldots (6)$$

and again, for a given c,

$$a = P\,(N)^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$A = F\,(M)^2 - Q \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

in which latter forms the area is calculated with one setting of the slide-rule, the constant Q in (8) being subtracted from the slide-rule result.

However, by means of second differences, the making of a table is still more facilitated, with the further advantage that the last area of the table checks all the other areas.

If t is the interval between values of c for which values of a and A are required, then the second differences are

$$\text{Second Differences for a, } 2\left(\frac{z^2}{2\,(z - s)}\right)t^2 \ldots\ldots (9)$$

$$\text{Second Difference for A, } 2\left(\frac{s\,z^2}{z^2 - s^2}\right)t^2 \ldots\ldots (10)$$

or, in other words: Twice the coefficient of the parenthesis of (3) or (4) multiplied by the square of the interval at which values of c are taken is the second difference for a or A, respectively. Adding this second difference to the difference between any two consecutive values of a or A for the corresponding value of c, gives the difference of the next two values of a or A. Sufficient areas should be calculated by the formula to give frequent checks on the work done by second differences.

In equation (4) divide numerator and denominator of the coefficient $\frac{s\,z^2}{z^2 - s^2}$ by $s\,z^2$, then

$$A = \frac{1}{\frac{1}{s} - \frac{s}{z^2}}\left(c + \frac{s}{K}\right)^2 - \frac{K^2}{s} \ldots\ldots\ldots (11)$$

and when the section is level, or $z = \infty$, $\frac{s}{z^2} = 0$, so that

$$A = s\left(c + \frac{K}{s}\right)^2 - \frac{K^2}{s} \ldots (12)$$

Consequently the flattest slope, or the largest value of z, to use in making a table is determined by the approach of $\frac{s\,z^2}{z^2 - s^2}$ to s, the side slope.

Of the two formulas (3) and (4), (3) is the least important tool, as the values of c to which it is appliacble are small and limited in number. Unlike formula (4), its parenthesis changes for each value of z, but the compensation is that c's partner $\frac{z}{K}$ in the parenthesis the table-maker the limiting value of c that a is to calculated for; all other values of c must be calcula by formula (4).

As an example, let it be required to make a table a 6-meter width of roadbed in cut, side slope being ¼ and surface slope ½:1; then s = ¼, z = ½ and K 3.00m. Substituting these values in (3) and (4)

$$a = \frac{(\tfrac{1}{2})^2}{2\,(\tfrac{1}{2} - \tfrac{1}{4})}\left(c + \frac{3}{\tfrac{1}{2}}\right)^2 = 0.5\,(c + 6)^2$$

for values of c from a cut of 6m. to a fill of 6m.; a

$$A = \frac{\tfrac{1}{4} \times (\tfrac{1}{2})^2}{(\tfrac{1}{2})^2 - (\tfrac{1}{4})^2}\left(c + \frac{3}{\tfrac{1}{4}}\right)^2 - \frac{(3)^2}{\tfrac{1}{4}} = 0.333\,(c + 12)^2 - 3$$

for all values of c from 6m. up.

For (3) or a, c taken at interval of t = 1,

$$\text{Second Diff.} = 2\,(0.5) \times 1^2 = 1.00$$

At interval of t = 0.1,

$$\text{Second Diff.} = 2\,(0.5) \times \overline{0.1}^2 = 0.01$$

And for (4) or A, c at interval t = 1,

$$\text{Second Diff.} = 2 \times 0.333 \times 1^2 = 0.666$$

For (4) or A, c at interval t = 0.1,

$$\text{Second Diff.} = 2 \times 0.333 \times \overline{0.1}^2 = 0.00666.$$

Process to get A values as follows:

	c (meter)	A (sq. mtr.)	Successive additions of Second Diffs.
Calculated by (4)	7 —	84.213	12.987 = First Diff. for c = 7 and c = 8
	8 —	97.200	.666
			13.653
	9 —	110.853	.666
			14.319
	10 —	125.172	.666
To check, Calculated by (4)	11 —	140.157	14.985
			etc.

The values of A for c at one-tenth intervals are filled in by the same process, each A for integral value of c, now serving as a check.

In the metric system, with 20-m. station, multiply A by 20 to get cubic meters per station and place in tables to nearest cubic meter.

Note that for s = ¼ and K = 3, the value [$(c + 12)^2 - 36$] for any given c is constant for all values of z. Taking c = 18m., the square of the parenthesis is 900, which multiplied by the difference of any two coefficients gives the difference of the areas in a cut of 18m. due to a change in z. Since when the section is level the coefficient is s = ¼, it is useless to make a table for such a slope z : 1 which when inserted in $\frac{s\,z^2}{z^2 - s^2}$, puts this coefficient very close to ¼.

Thus, for z = 3, $\frac{s z^2}{z^2 - s^2} = 0.2517$, and for a level section (z = ∞) it equals 0.2500

Difference .0017 × 900 gives a difference of 1.53 sq. m. area, or still a difference of 30.6 cu. m. per 22-m. station between a level section and a 3 : 1 slope for a cut of 18 m.

It is interesting to note that by removing all indices and suppressing the second term of (4), it becomes the expression for the horizontal distance E F, that is,

$$D = \frac{z\,s}{z - s}\left(c + \frac{K}{s}\right) \ldots\ldots\ldots\ldots\ldots (13)$$

also

$$D^1 = \frac{z\,s}{z + s}\left(c + \frac{K}{s}\right) \ldots\ldots\ldots\ldots\ldots (14)$$

In the example given $D = \tfrac{1}{2}\,(c + 12)$

$$D^1 = \tfrac{1}{6}\,(c + 12)$$

It is not practical to use D and D^1 for setting slope stakes, since ground slopes are not as regular as they are drawn on paper for deducing mathematical formulas. However, on steep slopes they are frequently useful in the field for determining easily whether the line should be shifted to avoid a retaining wall for example or to reduce embankment or excavation.

Very truly,
O. G. Bunsen,
Locating Engr. Mexican Central Ry.
El Limon, Jalisco, Mexico, Oct. 8, 1906.

◆

CONCRETE TELEPHONE POLES are being erected in Indiana by the Richmond Home Telephone Co. to test their efficiency. The poles consist of a skeleton framework of four corrugated-iron rods covered with concrete, the material being filled in about the framework while enclosed in a box-shaped mold. Each of the poles is 30 ft. long, octagonal in shape, and provided with mortices for cross arms and for use by linemen in climbing. The cross arms are fastened in place by iron bolts. Among the advantages of concrete poles for this work are supposed to be a longer life than that of wooden poles on account of not being affected by soil conditions; less cost; convenience in manufacture, as they can be made along the line where it is desired to install them; and better appearance, on account of being symmetrically tapered and straight.

ILLUMINATING ENGINEERING IN THE NEW ENGINEERING BUILDING OF THE UNIVERSITY OF PENNSYLVANIA.

The artificial lighting of the laboratories in the new engineering building recently dedicated at the University of Pennsylvania* affords an excellent example of the results obtained in that growing branch of the electrical art—illuminating engineering. Every room in this modern structure has been the subject of careful study from the lighting standpoint.

Both arc and incandescent lamps have been combined to produce the desired results, arc lamps of the enclosed type with concentric diffusers being used for illuminating the larger areas, and incandescent lamps, with concentrating reflectors, used singly and in clusters, for lighting hallways, lecture rooms, etc.

The basement is lighted by ordinary incandescent lamps and requires no special mention. On the first floor, however, the mechanical laboratory, with its heavy machinery and wide-open spaces, requires a general, brilliant illumination, with the light so diffused as to prevent shadows behind the machines. For this purpose enclosed arc lamps, with concentric diffusers, have been installed. The diffuser consists of a circular sheet-iron reflector in the form of a broad inverted cone, its white enamelled surface being corrugated in concentric circles and designed to distribute the light from the arc below so as to best illuminate the floor.

In the wood-working, iron-working and forge shops, and in the dynamo, testing and hydraulic laboratories, on the first floor, conditions prevail similar to those obtaining in the mechanical laboratories. Arc lamps with concentric diffusers are therefore used, and the excellence of this illumination can be seen in Fig. 1, which is reproduced from the original photographs taken by the light of the lamps. The absence of shadows and the even distribution of the light are particularly marked. Scattered incandescent lamps are available for lighting parts of machine and work.

The hallways are lighted with incandescent units of the G. E. M. type, which utilize 187 watts and concentrate 180 c. p. in a downward direction by means of Holophane Pagoda reflectors.

The drafting rooms, on the second and third floors, present the most interesting feature. The illumination in these rooms must be of the best, pure, brilliant and well diffused, so that the work can be done accurately. The enclosed arc lamp with concentric diffuser has been selected for this purpose with the result shown in Fig. 2. This illustration is also taken from a night photograph, and the sharpness of the illumination obtained, combined with the evenness of the distribution, is striking.

The assembly room, on the second floor, is lighted by four six-light incandescent clusters, one near each of the four corners. The illumination produced is soft and even, and does not distract the eyes. The library, on this floor, is lighted by G. E. M. units. The light here is stronger than in the assembly room, but at the same time is soft, well diffused and restful. The museums and auditorium, on the third floor, are both lighted by incandescent lamps arranged in clusters. General illumination is, of course, the chief requisite here. The lighting equipment throughout was installed by the General Electric Co.

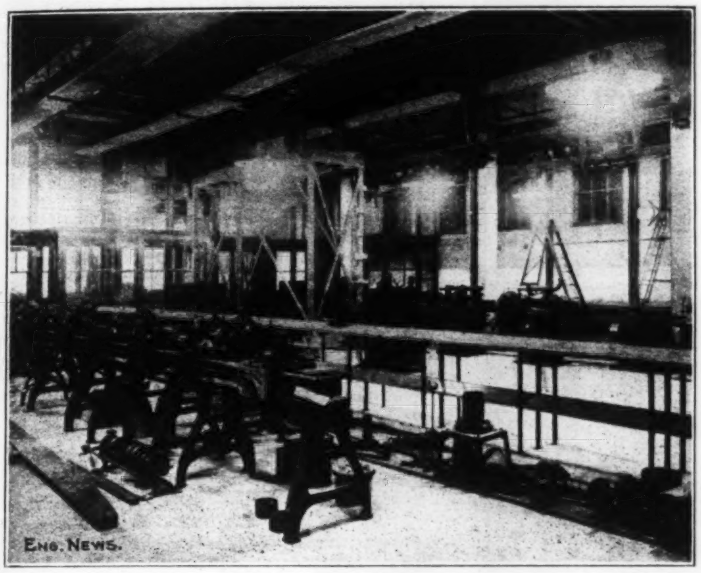


FIG. 1. MACHINE SHOP IN THE NEW ENGINEERING BUILDING OF THE UNIVERSITY OF PENNSYLVANIA, SHOWING THE EXCELLENT ILLUMINATION SECURED BY MEANS OF ARC LAMPS WITH CONCENTRIC DIFFUSERS.

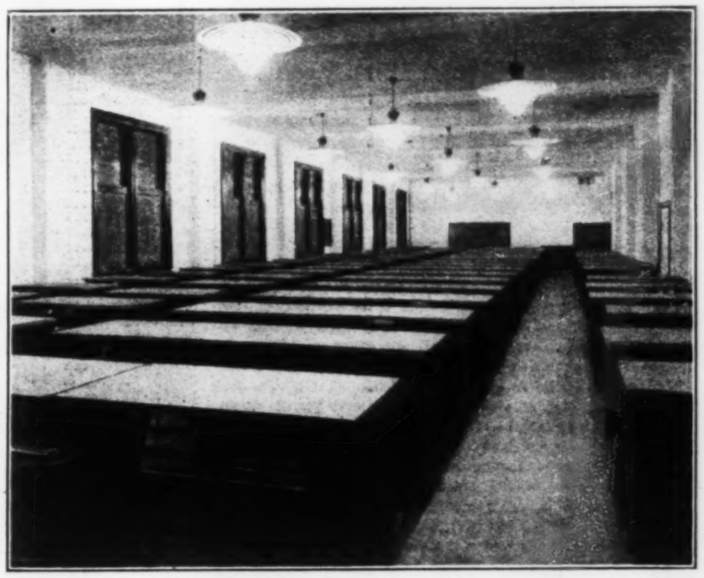


FIG. 2. DRAFTING ROOM IN THE UNIVERSITY OF PENNSYLVANIA ENGINEERING BUILDING.—ANOTHER EXAMPLE OF WELL-DIFFUSED ILLUMINATION.

The accompanying table shows the watts per sq. ft. used in the different parts of the building. It will be seen that the drawing rooms require the greatest amount of light, averaging 2.65 watts per sq. ft. of floor area, while the shops come next, with an average of 1.8 watts per sq. ft. With these figures as a basis, it would be quite possible to figure the amount of current necessary to light any building satisfactorily to meet different conditions, providing the floor areas are known.

Table of Watts per Sq. Ft. for Lighting Rooms Devoted to Engineering Instruction.

Room.	Watts per Sq. Ft.
Mechanical laboratory	1.0
Electrical laboratory	1.22
Dynamo laboratory	1.82
Work shops	1.84
Hydraulic laboratory	1.68
Testing laboratory	1.6
Testing laboratory, offiçes, standard room, etc.	0.72
Corridors (1st floor)	1.05
Corridors (2d floor)	0.81
Corridors (3d floor)	0.7
Drawing room (2d floor)	2.38
Drawing Room (3d floor)	2.63
Library	1.0
Assembly room	0.48
Museums	0.55
Auditorium	0.8

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[*] See Engineering News, Oct. 25, 1906; p. 435.

A MOTOR-DRIVEN FIRE WAGON has been placed in service by the London County Council Fire Brigade, according to "Compressed Air." It is not a fire engine but a wagon fitted with an extensible 55-ft. fire escape and a compressed air plant capable of throwing a jet of water under a pressure of 150 lbs. per sq. in., besides the regular boxes of tools and hose. The air plant consists of two steel tanks, containing air under 2,000 lbs. pressure per sq. in., which are connected to a 60-gal. water tank, each air tank having a capacity sufficient to discharge, at one compression, the water tank twice, it being refilled from the nearest hydrant. The wagon is driven by a 50-HP. gasoline engine, and a speed of 31 miles per hour can be maintained upon hilly roads. When fully loaded its total weight is 4¾ tons. The wagon has a wheel base of 11 ft. 6 ins. and measures 21 ft. over all, the chassis being suspended by ordinary semi-elliptic springs.

INFLUENCE OF MINERAL CONSTITUENTS OF THE MIXING WATER UPON THE STRENGTH OF PORTLAND CEMENT CONCRETE.

By James Otis Handy.*

As it is a very important matter to get all possible light on factors which may affect the durability of concrete, the following may be of interest to engineers.

In connection with dock construction at Ashtabula, Ohio, the contractors found that a water supply available at some distance from the lake would be convenient for a part of their work. The water came from an old slag fill and was of the following remarkable composition, the presence of thiosulphates (hyposulphites) in such large percentage, being outside our previous experience. The thiosulphates were of course derived from the sulphide of lime which is always present in blast-furnace slag.

Ashtabula Water.

	Parts per 100,000
Silica	1.80
Carbonate of lime	36.22
Carbonate of magnesia	.67
Sulphate of lime	31.28
Thiosulphate of lime	38.00
Thiosulphate of soda	64.75
Chloride of soda	6.04
Nitrate of soda	trace

As the action of such a water when used for mixing concrete could not be foreseen, practical tests were made. Batches of neat cement and of the usual 1:3 cement and sand mixtures were made up.

For one set, Pittsburgh hydrant water (Allegheny River water) was used. For the second set Ashtabula water was used. Pittsburgh water contains very little mineral matter.

Pittsburg Water.

	Parts per 100,000
Silica	.56
Carbonate of lime	2.68
Carbonate of magnesia	.46
Sulphate of lime	3.40
Sulphate of magnesia	.45
Chloride of soda	2.47

The results of the cement tests with the two waters were as follows:

Neat Tests.

	Pittsburg water.	Ashtabula water.
1 day	553 lbs.	....
7 days	781 lbs.	815 lbs.
28 days	805 lbs.	828 lbs.

Sand Tests. (1 Cement: 3 Sand.)

	Pittsburg water.	Ashtabula water.
7 days	233 lbs.	250 lbs.
28 days	362 lbs.	374 lbs.

The above figures are each the average of three briquettes. The cement, selected at random, was "Old Dominion" Portland.

It is evident from these tests that a water containing considerable amounts of sulphates and thiosulphates does not injure the strength of concrete, but seems to improve it. As natural waters vary greatly in composition, and as certain alkali salts would affect concrete injuriously, chemical and physical tests made in advance would seem a proper safeguard.

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[*] Chief Chemist of Pittsburg Testing Laboratory, Limited, Pittsburg, Pa.

THE RELATION OF THE DEPTH OF HARBOR CHANNELS TO MODERN SHIPPING.

In our issue of Sept. 6 we published an abstract of a paper by Mr. W. H. Wheeler, M. Inst. C. E., on the above subject. We are informed by Mr. E. L. Corthell, M. Am. Soc. C. E., that some of the main features of this paper were taken from his three papers on "Maritime Commerce," written for the American Association for the Advancement of Science, 1898, and for the meetings of the International Navigation Congress at Paris in 1900 and at Milan in 1905. While Mr. Wheeler's paper (in "The Engineer" of June 8 and 15, 1906) did not credit the figures to Mr. Corthell, it did contain the following reference to his work:

> With regard to the dimensions of the first-class ship of the future Sir Wm. White expressed his opinion that "it seems to be accepted now that a first-class port should have provision for ships up to 1,000 ft. in length, 100 ft. breadth of entrance and 33 ft. to 35 ft. draft of water." Mr. Corthell, after a careful study of all the statistics available, and after discussing the matter with naval architects and shipbuilders, and at the International Naval Congress at Paris in 1900 and subsequently at Milan in 1905, forecasted the vessel of 1948 as requiring the same dimensions as Sir W. H. White considered necessary. He had arrived at these figures by studying the laws of the annual increments of the dimensions of the 20 largest steamers during the past 43 years, and assuming that progress will proceed at the same rate. This draft of 35 ft. means a depth of water of 38 ft. in the entrance channels and over sea bars, 37 ft. in river channels, and 36 ft. over lock sills and in harbors and along quays and wharves.

Mr. Corthell also states that some erroneous figures were given in the table of depth of water at various ports which we appended to the article, and we therefore give below the figures for these ports as given in lengthy tables accompanying Mr. Corthell's paper for the 1905 meeting, which tables, he states, were made up from a personal correspondence with the engineers and port authorities. The dates of his figures are in general for the years 1903 and 1904. We quote a portion of Mr. Corthell's letter, as follows:

> Referring, for example, to one or two of the ports given in your table, I find the following depths at high water and proposed depths: New Orleans has 27.2 ft., and the proposed depth now being attained at the Southwest Pass is 36.2 ft., which latter ought to be shown. Panama Canal, I think, is 40 ft. instead of 35 ft. Vera Cruz is 34½ instead of 33, 33 being at low water. Montevideo has really no channel depth; it is an open entrance from the sea, but in the new port being built there it is proposed to have 30 ft. at low water, which would make about 35 ft. at high water. (Mr. Corthell's table gives 33 ft. at high water.—Ed.) Marseilles you give 52½ ft.; there is really no entrance to this port; the only entrances being into the docks which have much less than 52½ ft. (Mr. Corthell's table gives the present and proposed channel depths as 52½ ft. and 59.1 ft.—Ed.) Kaiser Wilhelm Canal you give 27.75 ft.; it is 29.5 ft. Lisbon you say "unlimited"; that is out in the middle of the Tagus River a mile or two from Lisbon. (Mr. Corthell's tables give 42.7 and 49.2 ft. for low and high water.) Liverpool you give 47½ ft. and 50½ ft.; depth at low water is 31½ ft. and at high water 52½ ft.; it is not intended at present, at least, to increase this depth. Southampton you give 39½ ft. and 44 ft.; it should be 35 ft. and 48 ft. (Mr. Corthell's own tables give 43 for present and 48 for future high-water depth.—Ed.) Glasgow you give 39½ ft.; it is 32 ft.
>
> A diagram given with my paper shows that the increase in steamships in dimensions, tonnage and every feature, are increasing even beyond the predictions which I made at the Paris Congress of Navigation in 1900. They were considered somewhat extravagant, so much so that a prominent French engineer in discussing the paper, while giving me great credit for the work that I had done in investigation, called me the "poet of navigation," but my paper to the Milan Congress showed that I was not a poet but a prophet. I may add that Mr. Vetillart, one of the leading experts in port works, presented a paper on the same subject, treated along theoretical and scientific lines, but coming to the same conclusions as I did along more practical lines. The Congress practically adopted our views.
>
> The work I have done on these lines during the last eight years has had a considerable influence, not only upon engineers, but upon the port authorities, and even the governments of the world. As an illustration, I may note that Mr. Dufourny, of Belgium, the General Secretary of the Permanent Commission of the International Navigation Congress, when my paper for the Milan Congress reached him at Brussels, wrote me that he had taken the liberty to use the data in the Belgium Parliament to influence it to enact legislation for the adequate deepening of the waterways and ports of the country.

CHANNEL DEPTHS AT VARIOUS PORTS.

	Present		Proposed		
	M.L.W. ft.	M.H.W. ft.	M.L.W. ft.	M.H.W. ft.	Dry Dock, ft.
New York	30	34.5	40	44.5	620 × 85 × 26
Boston	27	36.6	35	44.6	750 × 100 × 30
Philadelphia	26	31.3	30	35.3	707 × 104 × 30
Charleston	26.	31	26	31	....
New Orleans	24.8	26	35	36.2	525 × 100 × 28
Galveston	27	28.2	30	31.2	....
San Francisco	31.5	36.5	31.5	36.5	750 × 104 × 30.5
Quebec	30	45	30	45	600 × 66 × ..
Montreal	27.5	35.5	32	40	400............
Vera Cruz	32.8	34.5	32.8	34.5	....
La Plata	21	24.6	29.9	33.5	....
Rio Janeiro	50	53	50	53	480 × 70 × 20
Montevideo	24	27	30	33	450 × 53 × 19
Buenos Aires	22	24.6	24.3	26.9	591 × 65 × 23
Calcutta	27	27	27	27	520 × 67 × 21
Bombay	21	29.5	28.5	36.5	500 × 65 × 26
Havre	15.1	26.6	20	31.5	650 × 99 × 26
Marseilles	52.5	52.5	59.1	59.1	596 × 84 × 25
Antwerp	19.7	32.8	24.5	38.6	503 × 77 × 22
Zeebrugge	27.9	41	29.5	42.3	....
Rotterdam	22.7	27.6	24.6	29.6	813 × 69 × 21
Amsterdam	30	30	32.2	32.2	424 × 73 × 20
Kaiser Wm C'n'l	29.5	29.5	29.5	29.5	....
Hamburg	21.3	27.9	26.3	32.8	560 × 88 × 25
Bremerhaven	24.6	35.4	26.3	37.1	738 × 98 × 35
Barcelona	45.9	45.9	52.5	52.5	426 × 65 × 26
Bilbao	42.7	51.8	42.7	51.8	605 × 61 × 22
Cadiz	32.8	41	32.8	41	522 × 64 × 23
Lisbon	42.7	49.2	42.7	49.2	590 × 82 × 30
Brindisi	29.5	30.5	29.5	30.5	....
Riga	22	22	22	22	262 × 55 × 17
St. Petersburg	22	22	28	28	147 × 43 × 14
Stockholm	25.3	29.2	25.3	29.2	328 × 55 × 17
Copenhagen	30	30	30	30	470 × 70 × 24
London	28	48	30	50	824 × 77 × 33
Liverpool	31.5	52.5	..	..	925 × 94 × 29
Southampton	30	43	35	48	750 × 88 × 38
Plymouth	30	42	30	42	461 × 73 × 32
Barry (Cardiff)	21.6	49.5	21.6	49.5	858 × 59 × 27
Glasgow	22	32	22	32	880 × 83 × 27

ANNUAL REPORT OF THE INTERSTATE COMMERCE COMMISSION.

The 20th annual report of the Interstate Commerce Commission, issued on Dec. 19, lays particular stress on the rate legislation of last June as marking an epoch in railway transportation in this country. On account of the new law, the work of the commission has increased to a marked extent, particularly in the reporting of changes of tariff, 30 days' notice of which must now be given.

Generally speaking, the law has been well observed. Certain carriers have been somewhat lax, and in these cases it has been necessary to prosecute. The only suits decided against the government are two recent cases tried in the District Court in Colorado. Should this interpretation of the law be sustained by a higher court the statute will be greatly weakened.

The commission is endeavoring, by cooperation with the various railroads, pipe lines, etc., to establish some uniform system both for accounting and for the reporting of statistics to the government.

SHORTAGE OF CARS.

The inability of shippers to procure cars for the movement of their traffic is the subject of numerous and grievous complaints which come to the Commission from all parts of the country. A car famine prevails which brings distress in almost every section, and in some localities amounts to a calamity. The extraordinary prosperity which everywhere abounds, with the high prices obtainable for all classes of commodities have so stimulated production as to yield a volume of transportation business which far exceeds in the aggregate the carrying capacity of the railroads. In a word, the development of private industry has of late been much more rapid than the increase of railway equipment.

The conditions now existing in the Northwest, where large quantities of grain require immediate shipment, and in the Southwest and trans-Missouri region, where thousand and tens of thousands of live animals are denied movement to the consuming markets, may justly be regarded as alarming; while throughout the Middle West and Atlantic seaboard the shortage of cars for manufactured articles and miscellaneous merchandise has become a matter of serious concern. In some cases it is simply a lack of cars, in others insufficient and motive power, in still others wholly inad freight yards and terminal facilities.

The larger roads, which have been increasing equipment, as their managers claim, as rapidly could be procured, are in many cases refusing to nish cars for loading to points beyond their own because they are not unloaded and returned with reasonable time. Frequently, it is said, foreign are virtually confiscated by roads which get them possession and keep them in use for local service. surprising statement was recently made by a official of one of the largest and best equipped sys that 80 per cent of its cars was then beyond its trol on the lines of other roads.

The practice of allowing a car loaded on one to go through to destination, however distant, has so general, and the commercial need for such movem is so obvious and urgent, that a curtailment of interchange results in widespread hardship and co plaint. Moreover, it appears to be impossible for road to at once secure an adequate addition to its rolli stock, because every car and locomotive building tablishment is working to the limit of its capacity an orders placed now can not be filled much under a year.

Whatever the cause or however difficult to fix respo sibility, the unquestioned fact is that the railroads can not or do not move the entire volume of traffic offered, and that shippers are suffering to a degree almost un bearable in many cases because they can not get transportation for their traffic. A situation of such gravity calls for every remedy that can be usefully applied.

The Commission is without authority under any existing law to deal effectively with this condition. The regulating power of Congress has not been exercised to control the physical operations of interstate railroads, aside from the safety appliance requirements, either as respects the movement of trains or the supply of equipment. Nevertheless, the Commission, without waiting for further authority, has commenced an investigation of this subject with a view to ascertaing its causes, the conditions in different parts of the country, and the remedies that can be applied, either voluntarily by the carriers or by the compulsion of suitable enactments.

INCOME STATISTICS.

	1906	1905
Gross earnings	$2,319,760,030	$2,082,482,406
Gross earnings per mile	10,543	9,598
Operating expenses	1,532,163,153	1,391,791,255
Operating expenses per mile	6,963	6,254
Net earnings	787,596,877	690,691,151
Net earnings per mile	3,580	3,344

The income account statement of the railroads shows remarkable growth in earnings. The statement in the present report covers 99% of the mileage.

The amount of dividends declared in 1906 was $34,248,605 more than that shown for the dividends of practically the same roads in 1905. This preliminary report relates to operating roads only, and does not include the statement of any dividends paid by leased lines from the income they received as rent. The dividends declared by the subsidiary leased lines for the year 1905 were about $35,750,000.

SAFETY APPLIANCES.

The condition of equipment has continued favorable. Many old cars of light capacity have been retired from service and have been replaced by new cars of modern construction. This has had a good effect, as the new cars are all equipped with air brakes and have the latest couplers, which are stronger than those put in service a few years ago. There is also a tendency to limit the couplers used to four or five of the best makes, and this leads to uniformity and removes the necessity of keeping in stock a large number of repair parts.

A difficult problem connected with the coupler question is the matter of improper repair parts, leading to defects that can not be discovered until an attempt is made to operate the coupler when it is found inoperative. This leads to danger to employees and places carriers in the attitude of violators of law. The best interests of carriers would be served by purchasing only those repair parts that will fit the couplers to which they are applied.

Experience has demonstrated the need for an amendment to the law placing all appliances included in the master car builder's standards for the protection of trainmen under the regulation of law, such as sill steps, ladders, and roof handholds. Penalty defects are well looked after and properly repaired, but appliances not covered by the law are not infrequently allowed to pass in a defective condition. It is only by placing all these appliances in the same category that their safe and serviceable condition can be insisted upon at all times

As a result of the Commission's order increasing the minimum percentage of power brakes to be used in [illegible], there has been a considerable increase in the use of air brakes. The operation of this order has been beneficial, and indications are that freight trains will soon be controlled wholly by means of air brakes.

The loss of life occasioned by the use of comparatively light postal cars demands attention, and Congress should take some action to the end that this danger may be obviated.

The tremendous increase in the volume of freight traffic has put a severe strain upon employees, and this has often been made the justification of or excuse for working men unduly long hours, and has led to the employment of many young and inexperienced persons. In the matter of long hours the accident reports have shown instances of even worse conditions than existed in former years.

In the item of passengers killed in collisions and derailments the record for 1906 is not so bad as that of 1905. This is a cause for gratification; but the only real indication of the figures is that the number and severity of great disasters has diminished. The cost of collisions as reported by the companies, excluding damages to property and indemnities paid to or on account of persons killed or injured, is $10,659,189, nearly a million dollars greater than in 1905.

The statistical tables only serve to confirm the serious and pressing character of the threefold problem which has been made a feature of the last two or three annual reports; (1) the investigation of accidents; (2) the requirement by law that the block systems shall be used on passenger lines, and (3) the regulation by governmental authority of the evil of overwork by trainmen, signalmen, and telegraph operators.

The Commission, with the aid of experts, is engaged in an investigation of the use of and necessity for block systems and appliances for the automatic control of railway trains. This information is being put in shape to be reported to Congress and will be shortly transmitted.

NOTES FROM ENGINEERING SCHOOLS.

UNIVERSITY OF CINCINNATI.—In his presidential address on "The Present Status of Technical Education in Ohio," delivered before the Ohio Society of Mechanical, Electrical and Steam Engineers at the annual meeting held at Akron, Ohio, Nov. 16, President Wm. T. Magruder referred to a system of engineering education combining shop experience with college studies, recently established at the University of Cincinnati as follows:

> Within the last year or two, a system of cooperative engineering education has been devised by the University of Cincinnati, with the cooperation of about thirty-five of the largest mechanical and electrical manufacturing companies of Cincinnati and vicinity. The project contemplates a working arrangement whereby practical technical knowledge will be obtained in the factories, and the theory of engineering at the university; thus having the education of the head and hand progress together. Each one of the cooperating firms agrees to permit from two, to in some cases as many as ten, of their apprentices (depending of course upon the size of the plant) to pursue a special six-year course at the Universtiy during alternate weeks. The apprentices will work in pairs, each young man alternating with the other at the plant and at the University. In other words, one apprentice will work at the machine for one week, while the other pursues his engineering studies, exchanging places during the following week, and so on. Thus no machine at the plant will be idle at any time, and no loss will have to be borne by the employer. By omitting certain subjects, such as shop work and machine drawing, which the student under this cooperative plan will obtain a knowledge of at the plants, the special course, six years in length, although but for alternate weeks, will cover the work now included in the regular four years' curriculum. The manufacturers will pay the student apprentices for half time, according to the regular apprentice scale of wages. As a minimum, he starts at $4.80 per week. This is increased 60 cts. every six months. Some of the companies, however, pay $5.40 at the start. All students who complete their period of apprenticeship are given a bonus of $100 by the employer. It is evident that working but every other week, it will not be possible for a student to support himself entirely while working under this arrangement. However, he can earn about $1,600 during his six-years' course. As his college fees will average about $80 a year under this arrangement, or $500 for six years, he will have something over $1,000 to apply on his living expenses during the six years. During the summer the student apprentices will work full time at the plant. As board and lodging can be obtained at from $2.50 to $4 a week, it will be seen that the $1,000 earned by the young man during his course will go far towards paying his living expenses.
>
> It is claimed that this half-time course affords advantages both financially and educationally; the student practically supports himself, and obtains his theoretical and practical training at the same time. For admission to this special course, it is necessary for each candidate to secure a position as an apprentice in one of the cooperating plants. The brightest apprentices, those showing the greatest mechanical aptitude and the most remarkable ability, are selected by the employers to take the engineering course at the university. On the scholastic side, a high school education is required by the university for admission to the six-year engineering course, just as in the regular four-year course. However, boys recommended for admission by the owners of the plants, although not having the requisite high school education, may be permitted to take such work in the engineering course as they are prepared for, and at the same time receive instruction at the Technical School in the entrance subjects in which they are deficient. The Technical School is maintained by the University, and will be operated also on the alternate week basis. In cases of this kind, it will require, of course, a longer time than six years to complete the course and obtain the engineering degree. At the present time this cooperative plan applies only to the courses in electrical, mechanical and chemical engineering. On the completion of the course, the regular technical degree of Mechanical, Electrical or Chemical Engineer, as the case may be, will be conferred. The system was started at the University this fall and, at the present time, there are 30 young men working under this plan.

A TYPHOID EPIDEMIC AT SCRANTON, PA., had numbered 582 cases up to Dec. 25, of which all but 25 cases were reported in the 14 days beginning with Dec. 12. The outbreak is attributed to the water supply of one of the two companies supplying the city, the districts supplied by the other company being relatively free from the disease.

THE CHICAGO DRAINAGE CANAL is to be extended to Joliet, making an inland harbor at that place and also establishing a second power plant. The cost is estimated at $2,000,000. It will be necessary to build a new channel for Hickory Creek and have it enter the Desplaines River several miles below its present mouth. This distance will afford sufficient fall to prevent it backing up even when the canal is flowing its ultimate capacity of 840,000 cu. ft. per minute. The juncture of the canal and the Desplaines River will be made at Brandon Road, just below Joliet. To do this the Desplaines River will have to be made to conform to the canal dimensions, 200 ft. wide and 26 ft. deep for 2½ miles. Mr. R. R. McCormick, President of the Sanitary District, stated in an interview that the danger at Joliet in flood times caused by the Jackson St. dam obstructing the flow will be removed and a free flow given to the waters of the Desplaines River between concrete walls of a wide waterway through the heart of the city. At Brandon Road there will be a movable dam, so that no obstruction will be given the stream in flood times. To carry out this plan it will be necessary to remove the dam built by the Sanitary District for the Economy Light & Power Co., and this company will be reimbursed for actual damages. The District will assume the company's contracts with the city of Joliet and the State of Illinois and after furnishing these two purchasers with all the power they can use it expects to have a great deal left for further distribution.

NEW YORK'S SEVEN NEW SUBWAYS, described elsewhere in this issue, will have approximately the following lengths: Seventh and Eighth Ave. route, 16 miles; Lexington Ave. route, 12 miles; Jerome Ave. subway, 5¾ miles; West Farms and White Plains route, 4½ miles; Third Ave. route, 11 miles; Fourth Ave. and Bensonhurst route, 12½ miles; tri-borough route, 27½ miles, or about 4 miles in addition to the Third Ave. route and the Fourth Ave. and Bensonhurst route which forms a part of it. At a recent meeting of the New York Rapid Transit Commission it was resolved upon the recommendation of Chief Engineer George S. Rice to build the Lexington Ave. subway on the double-decked plan, having the local tracks near the street surface and the express tracks directly beneath them. The express tracks will then be about 35 ft. below the surface and the stations will be provided with escalators. This plan is necessitated by the narrowness of Lexington Ave.

TIES TREATED BY THE ZINC-TANNIN process have been used by the Chicago & Eastern Illinois Ry. since 1899, and in Bulletin No. 81 of the American Railway Engineering and Maintenance of Way Association it is stated that up to Jan. 1, 1906, about 1,250,000 such ties had been laid. During the seven years ending with that date, 6,087 treated ties had been removed from the track, but if those removed on account of changing tracks and, taking of tracks are excluded the number was only 1,489, including those reported as burned and destroyed by wrecks. The average rainfall along that line is about 37 ins. per year.

A STEAMER WRECKED A BRIDGE in Duluth Harbor, Superior, Wis., on Nov. 18, 1906. This is the second accident of the kind in that harbor within four months. On Aug. 11, 1906, a steamer collided with and completely wrecked the 491-ft. swing-span of the Interstate Bridge at the Gate, the entrance to the inner harbor of Duluth-Superior (see Eng. News of Aug. 30, 1906). On Nov. 18, 1906, a steamer collided with the south rest-pier of the Minnesota (northerly) draw-span of the Northern Pacific R. R. bridge at Rice Point, some distance inside the inner harbor. The rest-pier and the 160-ft. fixed span adjoining the draw to the south were completely wrecked; the draw was open at the time and remained uninjured. Fortunately the wreckage did not block the channel. A pile trestle has been built where the fixed span stood.

THE WEISSENSTEIN TUNNEL in northwestern Switzerland was holed through on Sept. 23, 1906, and a month later a survey check was made. The tunnel, 12,130 ft. long, lies just northwest of Solothurn, and connects the valleys of the Aar and Birs Rivers, both tributaries of the Rhine. It gives a direct line between Basel and Bern. The junction of headings occurred about 1,000 ft. from the north portal, at a point where the north heading had been stopped by a break through thin sandstone cover. The center lines prolonged from the two ends were $1^{15}/_{16}$ ins. or 0.16 ft. apart at the junction. The levels checked at two bench-marks, respectively 2,000 ft. and 2,300 ft. from the north portal, differed by $^{5}/_{16}$-in. (0.026 ft.) and $^{7}/_{16}$-in. (0.036 ft.), respectively. A preliminary check of lengths shows that the measured length is less than the calculated length by 2.17 ft.

THE ESTIMATED TRUE VALUE OF PROPERTY in the continental United States was $88,517,306,775 in 1900 and $107,104,211,917 in 1904, according to a circular just issued by the U. S. Bureau of the Census, Washington, D. C. The valuation for 1904 is divided as follows: Real property and improvements (exclusive of railroads and telegraph and telephone systems, which in certain states are classed as real property), $62,341,492,134; live stock, $4,073,791,736; farm implements and machinery, $844,898,863; manufacturing machinery, tools and implements, $3,297,754,180; gold and silver coin and bullion, $1,998,603,303; railroads and their equipment, $11,244,752,000; street railways, shipping, water-works, etc. (including telegraph and telephone systems, electric light and power stations, Pullman and private cars, and canals), $4,840,546,909; all other (including products of agriculture, manufactures and mining, imported merchandise, clothing and personal adornments, and furniture, carriage and kindred property), $18,462,281,792; total, $107,104,211,917. The average value of real property and improvements was $27.60 per acre in 1900 and $32.75 in 1904, and the corresponding per capita averages were $691.33 and $767.22.

RAILWAY IMPROVEMENTS ON THE SIX LINES entering Atlanta, Ga., have cost nearly $8,000,000 during the present year, as follows: Southern Ry., $3,000,000; Atlanta, Birmingham & Atlantic Ry., $2,000,000; Louisville & Nashville Ry., $2,000,000; Seaboard Air Line, $400,000; Central Ry. of Georgia, $200,000; Western & Atlantic Ry., $200,000. The expenditures of the three last lines have been principally for extensive freight yards near Atlanta, while the other three roads have also made heavy expenditures on freight yards and terminal facilities at that city. The Louisville & Nashville Ry. is building a new line which will give a more direct route between Cincinnati and Atlanta, and the Atlanta, Birmingham & Atlantic Ry. is building a new line into the city.

COMPRESSED AIR is now used in the large iron foundry at the Schenectady works of the General Electric Co. for almost every operation connected with the making of a finished casting. Although the machinery in the other adjacent shops is operated entirely by electricity, in the iron foundry where the operations are scattered and intermittent, compressed air was found to be advantageous for small power services. The air is supplied at 80 lbs. pressure by a number of electric motor-driven compressors of different capacities. A compressor of 1,700 cu. ft. per minute capacity, driven direct by a 225-HP., 10,000-volt motor renders the iron foundry independent of the general compressed air service. On the main floor 63 Tabor molding machines in constant use are driven by the compressed air, The cars in eight core ovens are operated back and forth by the same agent. The jib cranes are equipped with compressed air lifting cylinders for handling flasks, and compressed air operates the blowers in the cupolas when the pig iron is melted, the heating and ventilating fans, the sand blast apparatus, and the pneumatic clipping tools for dressing castings. It may be added that the foundry has recently been enlarged and the main structure is 880 ft. by 140 ft., with a wing 170 ft. by 120 ft. Altogether, there are '214,000 sq. ft. of floor space, 5 cupolas and 1,030 employees. These produce 45,000 castings per week, weighing in all about 550 tons.

MUNICIPAL ORGANIZATIONS IN THE UNITED States, according to figures compiled by the National Municipal League, number 1,031 at the present time. In the number are included municipal and civic leagues, good government and city clubs, civic federations and the like, and also various business and other organizations which devote more or less of their time and energy to some phase or phases of municipal affairs.

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THE ELECTRICAL EQUIPMENT OF THE ZOLLERN colliery in Germany is interesting by reason of the system of control employed and the use of a motor-generator for preventing abnormal fluctuations in the current used. The armatures of the hoisting motors are connected directly without switches to the armature of a generator, the voltage of which can be varied at will, the field strength of the hoisting motors being maintained at a constant value. The winding drum is driven by two direct-current motors, each of which is rated at 750 HP. at 500 volts. These motors receive their power from a motor-generator. The whole of the starting, stopping, speed regulation and reversing is done by one switch, which operates a resistance placed in the shunt field circuit of the generator of the motor-generator set. By this means only currents of small magnitude are dealt with, the burning of contacts is avoided, and heavy and expensive resistances are not necessary. Practically no power is wasted in resistance when the winding drum is run at reduced speeds. A small amount of energy is returned to the motor-generator from the winding motors during retardation, and this is usefully applied in accelerating an enormous fly-wheel used with the motor-generator, instead of being consumed by friction in braking. The Allis-Chalmers Co., of Milwaukee, Wis., who control the American rights of the Ward Leonard multiple-voltage system of speed control used at the Zollern colliery, have supplied us with the foregoing description of the electrical equipment.

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PERSONALS.

Mr. Oscar Sanne has been appointed Structural Iron Designer in the Bridge Department of the city of Chicago.

Mr. Percy H. Todd has been elected Vice-President of the Bangor & Arrostook R. R., to succeed Mr. Wilbert A. Burrleigh, resigned.

Mr. Jeremiah Murphy, Roadmaster of the Texas & New Orleans R. R., has been appointed Resident Engineer at Lafayette, La., of the Southern Pacific's Louisiana lines.

Mr. Frank C. Loring, General Manager of the Trethewey Silver-Cobalt Mine, Ltd., of Cobalt, Ont., has resigned, to take up private practice. He will, however, act as Consulting Engineer to the company.

Mr. H. E. Warrington has been appointed Chief Engineer of the Cincinnati, New Orleans & Texas Pacific Ry., with office at Cincinnati, O. He succeeds George B. Nicholson, deceased. Mr. J. C. Nelson has been appointed Assistant Chief Engineer, with headquarters at the same place.

Mr. Homer M. Derr has been appointed Professor of Civil Engineering at South Dakota Agricultural College, Brookings, S. D. He is a graduate of Leland Stanford University, receiving the degree of A. B. Later he received the degree of A. M. from Columbia University and obtained his doctor's degree (Ph. D.) from the University of Pennsylvania.

Obituary.

Edward P. Bullard, President of the Bullard Machine Tool Co., of Bridgeport, Conn., died at Braidentown, Fla., Dec. 22, of heart trouble, aged 65 years.

Charles Daniel Moyer, Secretary and Treasurer of the Chicago Junction R. R. and the Union Stock Yards & Transit Co., died Dec. 12, after an operation for appendicitis.

G. W. Kallman, formerly connected with Board of Public Works, of Detroit, Mich., as a civil engineer, died at his home in that city Dec. 16, of pneumonia, aged 29 years.

Andrew Gleeson, a retired contractor of Washington, D. C., died at his home there Dec. 21, of paralysis, aged 72 years. Mr. Gleeson was born in Ireland, but had lived in Washington since a boy.

Samuel Little, formerly President of the West End Railway Co., of Boston, Mass., died at Boston Dec. 21, of apoplexy, aged 80 years. He had also served as President of the E. Howard Watch & Clock Co. and the Boston Lead Manufacturing Co.

James Thomas, senior member of the firm of Davies & Thomas, Foundrymen, Catasauqua, Pa., died at Allentown, Pa., Dec. 18, aged 70 years. The contract for making the tubing for the Pennsylvania North River tunnels was received by Mr. Thomas. He was at one time Manager of the Baldwin Locomotive Works.

Frederick J. Schaffhauser, a civil engineer in the Water Bureau of Philadelphia and the most important witness in the suit of that city to recover $5,000,000 from James P. McNichol on filtration contracts, died Dec. 25 from wounds inflicted Nov. 9 by Frederick Hornberger, an assistant engineer. It is stated that Hornberger is demented.

E. P. Wright, a director of the Cleveland (O.) Telephone Co., died at his home in Cleveland, Dec. 18, aged 70 years. He was born at Hammondsport, N. Y., and was formerly Manager of the Cleveland office of the Western Union Telegraph Co. Mr. Wright was one of the incorporators of the Cleveland Telephone Co. and its first Vice-President.

Adam Weber, an inventor and manufacturer of illuminating gas retorts and accessories, died at his home in New York City, Dec. 22, of apoplexy, aged 81 years. Mr. Weber was born at Wurms am Rhine, Germany, and was educated at the Universities of Heidelberg and Mainz as an architect. On coming to this country, however, he became interested in the improvement of gas systems and designed and built gas plants in some of the largest cities of the United States.

Arthur Price Law, Assoc. M. Am' Soc. C. E., Superintendent of Construction for the Holbrook, Cabot & Rollins Corporation, Engineers and Contractors, Boston, Mass., died at his home in East Providence, R. I., Nov. 19, of typhoid fever, aged 36 years. Mr. Law was formerly employed as an assistant on Government surveys in Florida, and in 1893 secured a position with the New York, New Haven & Hartford R. R. He remained with them as Junior and Senior Assistant Engineer until 1900, when he became Superintendent of Construction, in charge of deep foundations and substructural work, for the Holbrook, Cabot & Rollins Corporation.

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ENGINEERING SOCIETIES.

COMING MEETINGS.

- AMERICAN ECONOMIC ASSOCIATION.
  - Dec. 26-28. Nineteenth Annual Meeting at Providence, R. I. Secy., Mr. Winthrop M. Daniels, Princeton, N. J.
- AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.
  - Dec. 27-Jan. 2, '07. Annual Meeting at New York City. Secy., L. O. Howard, Cosmos Club, Washington, D. C.
- ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
  - Jan. 3. Annual Meeting at Pittsburg, Pa. Secy., F. V. McMullin, 410 Pennsylvania Ave., Pittsburg, Pa.
- THE AMERICAN INSTITUTE OF ARCHITECTS.
  - Jan. 7-9. Annual Convention at Washington, D. C., Secy., Glenn Brown, Washington, D. C.
- MICHIGAN ENGINEERING SOCIETY.
  - Jan. 8. Annual Convention at Detroit, Mich. Secy., F. Hodgman, Climax, Mich.
- NATIONAL ASSOCIATION OF CEMENT USERS.
  - Jan. 8-11. Annual Meeting at Chicago, Ill. Secy., W. W. Curtis, 585 Caxton Bldg., Chicago, Ill.
- NEW ENGLAND WATER-WORKS ASSOCIATION.
  - Jan. 9. Annual Meeting at Boston, Mass. Secy., Mr. Willard Kent, Narragansett Pier, R. I.
- IOWA ENGINEERING SOCIETY.
  - Jan. 9-11. Annual convention at Ottumwa, Ia. Secy., A. W. Ford, Iowa City, Ia.
- WOOD PRESERVERS' ASSOCIATION.
  - Jan. 15. Annual Meeting at Memphis, Tenn. Secy., C. W. Berry, Laramie, Wyo.
- AMERICAN SOCIETY OF CIVIL ENGINEERS.
  - Jan. 16-17. Annual Meeting at New York City. Secy., C. W. Hunt, 220 West 57th St., New York.
- NORTHWESTERN CEMENT PRODUCTS ASSOCIATION.
  - Jan. 16-18. Annual Convention at St. Paul, Minn. Secy., Martin T. Roche, 410 Pioneer Press Bldg., St. Paul, Minn.
- INDIANA ENGINEERING SOCIETY.
  - Jan. 17-19. Annual Meeting at Indianapolis. Secy., C. C. Brown, Commercial Club Building, Indianapolis, Ind.
- THE ENGINEERS' CLUB OF PHILADELPHIA.
  - Jan. 19. Annual Meeting at Philadelphia. Secy., Walter Loring Webb, 1122 Girard St., Philadelphia, Pa.
- AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
  - Jan. 22-24. Annual Meeting at New York City. Secy., W. M. Mackay, P. O. Box 1818, New York City.
- OHIO ENGINEERING SOCIETY.
  - Jan. 22-24. Annual convention at Columbus, Ohio. Secy., E. G. Bradbury, 85 North High St., Columbus, Ohio.
- ILLINOIS SOCIETY OF ENGINEERS AND SURVEYORS.
  - Jan. 23-25. Annual Meeting at Peoria, Ill. Secy., E. E. R. Tratman, 1636 Monadnock Block, Chicago, Ill.
- CANADIAN SOCIETY OF CIVIL ENGINEERS.
  - Jan. 29. Annual Meeting at Montreal. Secy., Prof. C. H. McLeod, 877 Dorchester St., Montreal, Quebec.
- THE NATIONAL BRICK MANUFACTURERS' ASSOCIATION.
  - Feb. 4-16. National Convention at St. Louis, Mo. Secy., Theo. A. Randall, Indianapolis, Ind.
- NEW ENGLAND GAS ASSOCIATION.
  - Feb. 21. Annual Meeting at Boston, Mass. Secy., N. W. Gifford, East Boston, Mass.
- ASSOCIATION OF ONTARIO LAND SURVEYORS.
  - Feb. 26. Annual Meeting at Toronto. Secy., Killaly Gamble, 405 Temple Bldg., Toronto, Ont.

ENGINEERS' CLUB OF CINCINNATI.—The annual meeting of the club was held in the club rooms at 25 East Eighth St., Cincinnati, O., Dec. 20, at 7.30 p. m., when the following officers were elected: President, Mr. H. C. Innes; Vice-President, Mr. F. M. Crocker; Secretary and Treasurer, Mr. E. A. Gast; Director, Messrs. A. W. Owen, Adam Ritter and E. H. Berry.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—The regular bi-weekly meeting was held at the house of the society, Wednesday, Dec. 19, President F. P. Ste the chair. An abstract was read of the paper, "Recent Practice in Hydraulic-Fill Dam Constr by James D. Schuyler. The paper was discus Messrs. Clemens Herschel, Wm. L. Butcher and Dabney.

OKLAHOMA ENGINEERS' AND SURVEYOR CIETY.—This society was organized at Oklahoma Okla., Dec. 5. Prof. D. E. Chandler, of Stillwater, was chosen President; Mr. H. V. Hinkley, of Su Ind. T., First Vice-President; Mr. D. B. Merry, of land, Okla., Second Vice-President, and Mr. J. E. J of Norman, Okla., Secretary and Treasurer. The ecutive Committee is composed of the officers of society.

NEW YORK RAILROAD CLUB.—The regular mo meeting of the club was held at Carnegie Hall Dec The paper of the evening was by Mr. Paul R. Br on "Railroading from a Business Point of View," gist of it being that railroads were not run with same care to details as are the large mercantile manufacturing establishments. In the discussion followed the reading of the paper, Messrs. M. B. W Statistician of the Baltimore & Ohio R. R., W. G. Be Vice-President and General Manager of the Cen Railroad of New Jersey, and others took exception Mr. Brooks' statements.

WOOD PRESERVERS' ASSOCIATION.—The annual meeting of the Association will be held at the Gay Hotel, Memphis, Tenn., Jan. 15. Some 20 differ papers, on as many different subjects, will be presented at the convention, among them being: "Causes of Decay in Timber"; "Best Practice of Treating Butts of Telegraph, Telephone and Signal Poles"; "Advisability of Treating Mine Material"; "Advantages of Continuous Rail Joints in Preventing Mechanical Wear on Ties, and Other Mechanical Devices Used for the Same Purpose"; "Species of Wood Best for Treatment"; "Best Method of Seasoning Ties for Treatment," and "Progress of Timber Preservation During 1906."

NORTHWESTERN CEMENT PRODUCTS ASSOCIATION.—The Association's transportation committee has secured special rates from the Western Passenger Association, of a fare and a third, from all points in Iowa, Minnesota, Wisconsin, Montana, North and South Dakota, Illinois and Nebraska to St. Paul, Minn., for the annual convention, Jan. 16-18. This rate will be good from Jan. 13 to 21, inclusive. To secure this special rate the purchaser, upon buying his ticket (regular fare), must ask for a certificate receipt, and then present this receipt to the Secretary of the Association at Convention Hall, the new Auditorium, upon his arrival at St. Paul. The Secretary will see that the receipt is properly signed and returned to the owner, and when so signed, it will entitle him to return to his original destination, at one-third of the regular fare.

NEW YORK ELECTRICAL SOCIETY.—The 264th meeting of this society was held Wednesday evening, Dec. 19, in the Edison Auditorium, 44 West 27th St. About 150 were in attendance. Mr. A. O. Benecke of the American Instrument Co., Newark, N. J., delivered an address on "Electrical Measuring Instruments" in which he discussed the mechanical and electrical problems involved in their construction. He took up first the permanent magnetic field, then the action of the damping frame and the winding of the movable coil. He showed how necessary it was to have the movable coil light in weight and of ample current-carrying capacity so as not to heat appreciably when in action. Copper strip meets the conditions very satisfactorily, giving ample radiation, greater flexibility, and carrying less weight of insulation than a single round wire or even two single round wires in multiple, each of half the required cross-section. He next considered the relation between the controlling force, torque, and weight of the moving system, and the pivoting of the movable coil. The old-time pointed pivot working in a hollowed-out jewel is being superseded by a flat pivot working on a flat bearing surface and maintained in position by side guides. The advantage of the new form is that the bearing surface can be better polished and can be maintained in superior condition to the old kind, thereby ensuring a lower frictional resistance. Series resistances and shunts were then discussed. In a voltmeter 1,500 ohms per volt is generally provided in the series resistance. Shunts, he said, should be made of copper rather than of alloys as is sometimes done, the reason being that with a copper shunt there will be no terminal electromotive force developed between the shunt and the copper terminals, whereas with a shunt composed of an alloy there will be a terminal electromotive force. He also advised laminating the strips of the shunt. Referring to the shielding of a meter from external magnetic fields, he said, a sheet-iron case answers the purpose much better than a cast-iron case. Many points in the lecture were illustrated with lantern slides. It is expected the January meeting of the society will be held in the new engineering building and that Mr. Frank J. Sprague will then deliver an address on electric railways.

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, December 27, 1906.

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CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

The following Plans (P.), Specifications (S.) and Bidding Sheets (B. S.) may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York:

Bids close. Work. Place. On file. See issue
Dec.
[illegible]–Garbage destructor..New York..P., S. & B. S..12-13
*26—Power plant..Washington, D. C..S. & B. S.....11-29
Jan.
4—Pumping engines..Phila. Pa.....S. & B. S.....12-13
5—Blasting..Portsmouth, N. H.....S............12-13
*5—Subway..West Point, N. Y......P., S. & B. S..12-27
*8—Asphalt plant..Toronto, Ont....P., S. & B. S..12-27
*8—Dredging..New York, N. Y......S. & B. S.....12-20
12—Dredges, Panama ....S. & B. S.....12-27
19—Wharf..New Orleans, La........S............12-27

*Work advertised in Engineering News.

LIST OF CONTRACTS PENDING.

LIGHT, HEAT AND POWER PLANTS.

Bids close. Work. Place. On file. See issue
Dec. 31.Lighting equipment, New York, N. Y..Dec. 20
Jan. 4.Boilers, Clay Center, Kan..............Dec. 20
Advertised, Eng. News, Dec. 20.
Jan. 5.Subway, West Point, N. Y..............Dec. 20
Advertised, Eng. News, Dec. 20 to Jan 3.
Jan. 10.Electric equipment, Pasadena, Cal......Dec. 6
Jan. 15.Power-house, Nanticoke, Pa.............Dec. 20
Advertised, Eng. News, Dec. 20 and 27.
Feb. 1.Gas works, Richmond, Va..............Dec. 6
Advertised, Eng. News, Dec. 6.
Mar. 7.Lighting, Natchez, Miss................Dec. 20
Advertised, Eng. News, Dec. 20 and 27.

BRIDGES.

Dec. 27.Bridge, Toledo, Ohio ....Dec. 13
Dec. 29.Bridge, Greenfield, Ind..................Dec. 6
Dec. 29.Approach, Rockville, Ind..................Dec. 20
Dec. 29.Bridge, Indianapolis, Ind..................Dec. 20
Jan. 3.Bridge, Urbana, Ill..................Dec. 27
Jan. 3.Plans, Lafayette, La..................Dec. 20
Jan. 4.Bridge, Manistee, Mich..................Dec. 13
Advertised, Eng. News, Dec. 13.
Jan. 7.Bridges, York, Neb..................Dec. 20
Jan. 8.Bridge, Hattiesburg, Miss..................Dec. 20
Jan. 9.Bridges, Walla Walla, Wash..................Dec. 20
Jan. 9.Bridges, Fremont, Neb..................Dec. 27
Jan. 9.Bridges, Creston, Iowa..................Dec. 27
Jan. 12.Bridges, Wichita, Kan..................Dec. 27
Jan. 15.Bridges, Colfax, Wash..................Dec. 27
Jan. 16.Drawbridge, Cambridge, Mass..................Dec. 27
Advertised, Eng. News, Dec. 27.
Jan. 16.Bridge, Memphis, Tenn..................Dec. 27

BUILDINGS.

Dec. 27.Heating, Edmonton, Alta..................Dec. 20
Dec. 28.Mess hall, Klamath Agency, Ore.........Dec. 13
Dec. 29.Shelter, Fort Assinniboine, Mont.........Dec. 6
Advertised, Eng. News, Dec. 6 to 27.
Dec. 29.School, Covington, La..................Dec. 13
Dec. 30.Manufacturing plant, Two Rivers, Wis..Nov. 29
Jan. 2.Post-office, Wausau, Wis..................Nov. 29
Advertised, Eng. News, Nov. 29 and Dec. 6.
Jan. 3.Boilers, etc., Panama ....Dec. 27
Jan. 3.High school, Syracuse, N. Y..................Dec. 27
Jan. 4.Plumbing system, etc., Buffalo, N. Y....Dec. 27
Jan. 4.High school, Buffalo, N. Y..................Dec. 27
Jan. 4.Coal pockets, Philadelphia, Pa..........Dec. 6
Advertised, Eng. News, Dec. 6 to 27.
Jan. 4.Light-house, Baltimore, Md..................Dec. 6
Advertised, Eng. News, Dec. 6.
Jan. 5.Brewery, Strathcona, Alta..................Dec. 27
Jan. 5.Improving stable, Washington, D. C......Dec. 27
Advertised, Eng. News, Dec. 27.
Jan. 7.School, New York, N. Y..................Dec. 27
Jan. 7.Post-office, Newport, R. I..................Dec. 6
Advertised, Eng. News, Dec. 6 and 13.
Jan. 8.Hospital school, New York, N. Y........Dec. 27
Jan. 10.Foundations, Atlanta, Ga..................Dec. 13
Jan. 14.Building, Cheyenne, Wyo..................Dec. 20
Advertised, Eng. News, Dec. 20 to Jan. 10.
Jan. 14.Bank, office building, Shreveport, La.....Dec. 27
Jan. 15.Plans, Carthage, Ill..................Dec. 27
Jan. 15.Post-office extension, Dallas, Tex........Dec. 13
Advertised, Eng. News, Dec. 13 and 20.
Jan. 16.Mess-hall, Talklai, Ariz..................Dec. 20
Jan. 31.Heating, Crawfordville, Ind..................Dec. 27
Feb. 1.Leprosy hospital, Hawaii ....Dec. 13
Advertised, Eng. News, Dec. 13 and 20.
Feb. 1.Factory, Kokomo, Ind..................Dec. 6
Feb. 4.Court-house, New Orleans, La..................Dec. 27
Feb. 8.Library, University, N. Dak..................Nov. 15
Apr. 15.Plans, Ottawa, Ont..................Dec. 20

WATER SUPPLY AND IRRIGATION.

Dec. 27.Water pipe, Boston, Mass..................Dec. 27
Dec. 28.Water-works, Klamath Agency, Ore....Dec. 6
Dec. 28.Water mains, New York, N. Y..................Dec. 20
Dec. 28.Pumping engines, etc., Ada, Ind. T......Dec. 20
Advertised, Eng. News, Dec. 20 and 27.
Dec. 29.Pumping plant, Tacoma, Wash..................Dec. 20
Dec. 31.Tank, Fortress Monroe, Va..................Dec. 6
Advertised, Eng. News, Dec. 6 to 27.
Dec. 31.Pipe, Winnipeg, Man..................Dec. 6
Dec. 31.Supplies, Calgary, Alta..................Dec. 13
Dec. 31.Mains, Norwood, Ohio ....Dec. 20
Jan. 2.Tanks, Arcola, Sask..................Dec. 27
Jan. 4.Pumping engines, Philadelphia, Pa.....Dec. 6
Advertised, Eng. News, Dec. 6 to 27.
Jan. 5.Supplies, Albuquerque, N. Mex..........Dec. 27
Jan. 9.Pipe, etc., Coalgate, Ind. T..................Dec. 27
Advertised, Eng. News, Dec. 27 and Jan. 3.
Jan. 9.Dam, etc., Mitchell, Neb..................Nov. 22
Advertised, Eng. News, Nov. 22 to Jan. 3.
Jan. 7.Water-works, Rolla, Mo..................Dec. 20
Jan. 10.Water supply, Elkhart, Ind..................Nov. 29
Jan. 15.Water-works, Bisbee, Ariz..................Dec. 13
Advertised, Eng. News, Dec. 13 to Jan. 3.
Jan. 15.Pumps, Meadville, Pa..................Dec. 20
Jan. 15.Water-works, Pineville, La..................Dec. 20
Jan. 15.Water tunnel, etc., Gary, Ind..........Dec. 20
Advertised, Eng. News, Dec. 20 to Jan. 3.
Jan. 22.Reservoir embankment, Granite, Colo...Dec. 20
Advertised, Eng. News, Dec. 20 to Jan 3.
Jan. 23.Pipe, New Orleans, La..................Nov. 15
Advertised, Eng. News, Nov. 15 to Jan. 17.
Jan. 24.Steel bars, Mitchell, Neb..................Dec. 13
Advertised, Eng. News, Dec. 13 to Jan. 3.
Jan. 28.Pumping engines, Muskegon, Mich......Dec. 20
Mar. 1.Pipe and specials, Winnipeg, Man......Dec. 20
Advertised, Eng. News, Dec. 20 to Feb. 21.
No date.Water development, Buena Vista, Ga....Dec. 27
Advertised, Eng. News, Dec. 27.

SEWERAGE.

Dec. 27.Sewers, New York, N. Y..................Dec. 13
Dec. 28.Supplies, Columbus, Ga..................Dec. 27
Dec. 29.Ditch, Champaign, Ill..................Dec. 27
Dec. 31.Sewers, Little Rock, Ark..................Dec. 27
Jan. 2.Sewers, Oakland, Cal..................Dec. 20
Jan. 2.Ditch, Rosemond, Ill..................Dec. 20
Jan. 7.Sewers, Rolla, Mo..................Dec. 6
Jan. 7.Sewers, Beresford, S. Dak..................Dec. 27
Jan. 7.Sewers, Webb City, Mo..................Dec. 27
Jan. 12.Sewers, Merchantville, N. J..................Dec. 13
Advertised, Eng. News, Dec. 13, 27 and Jan. 10.
Jan. 15.Sewers, Bisbee, Ariz..................Dec. 13
Advertised, Eng. News, Dec. 13 to Jan. 3.
Jan. 15.Disposal plant, Bisbee, Ariz..................Dec. 13
Advertised, Eng. News, Dec. 13 to Jan. 3.
Jan. 21.Sewers, Wichita, Kan..................Dec. 13
Advertised, Eng. News, Dec. 13 to 27.
Jan. 22.Sewers, Cedar Falls, Iowa ....Dec. 20
Advertised, Eng. News, Dec. 20 and 27.
Jan. 22.Sewers, Van Buren, Ark..................Dec. 27
Advertised, Eng. News, Dec. 27 and Jan. 3.
Jan. 23.Sewers, Orangeburg, S. C..................Dec. 27
Advertised, Eng. News, Dec. 27 to Jan. 17.
Feb. 4.Sewer, Cape Girardeau, Mo..................Dec. 20
Advertised, Eng. News, Dec. 20 and 27.
Mar. 18.Sewers, Burlington, Iowa..................Dec. 27
Advertised, Eng. News, Dec. 27.

STREETS AND ROADS.

Dec. 26.Paving, Cincinnati, Ohio..................Dec. 6
Dec. 27.Paving, Niagara Falls, N. Y..................Dec. 20
Dec. 27.Park, New York, N. Y..................Dec. 20
Dec. 29.Resurfacing, Sharpsburg, Md..................Dec. 6
Dec. 31.Paving, New Orleans, La..................Dec. 27
Jan. 4.Paving, Steubenville, Ohio ....Dec. 27
Jan. 4.Paving, Cincinnati, Ohio ....Dec. 20
Jan. 5.Roads, Terre Haute, Ind..................Dec. 20
Jan. 7.Paving, Newburgh, N. Y..................Dec. 6
Advertised, Eng. News, Dec. 6 and 13.
Jan. 7.Macadam, Amityville, N. Y..................Dec. 6
Advertised, Eng. News, Dec. 6 and 13.
Jan. 7.Roads, Knox, Ind..................Dec. 20
Jan. 8.Roads, Bedford, Ind..................Dec. 20
Jan. 8.Roads, Bloomfield, Ind..................Dec. 20
Jan. 8.Roads, Columbus, Ind..................Dec. 20
Jan. 8.Roads, Versailles, Ind..................Dec. 20
Jan. 8.Asphalt plant, Toronto, Ont..................Dec. 20
Advertised, Eng. News, Dec. 20 and 27.
Jan. 8.Paving, Troy, Ohio..................Dec. 27
Jan. 9.Grading, etc., New York, N. Y..................Dec. 27
Jan. 9.Roads, Bloomington, Ind..................Dec. 20
Jan. 9.Roads, Rockville, Ind..................Dec. 20
Jan. 10.Paving, Norfolk, Va..................Dec. 20
Advertised, Eng. News, Dec. 20 to Jan 3.
Jan. 10.Macadam, Norfolk, Va..................Dec. 20
Advertised, Eng. News, Dec. 20 to Jan. 3.
Jan. 15.Macadam, Cleveland Heights, Ohio .....Dec. 27
Jan. 16.Paving, Cincinnati, Ohio ....Dec. 27

MISCELLANEOUS CONTRACTS.

At once.Railroad grading, Virginia..................Dec. 27
Advertised, Eng. News, Dec. 27.
Dec. 27.Armory equipment, New York, N. Y.....Dec. 13
Dec. 27.Destructor plans, New York, N. Y......Nov. 29
Dec. 27.Fire alarms, New York, N. Y..................Dec. 20
Dec. 27.Fire hose, New York, N. Y..................Dec. 20
Dec. 27.Tunnel entrance, Boston, Mass..................Dec. 20
Advertised, Eng. News, Dec. 20.
Dec. 28.Sea wall, etc., New York, N. Y..................Dec. 20
Dec. 28.Dredging, New York, N. Y..................Nov. 29
Advertised, Eng. News, Dec. 6 to 27.
Dec. 28.Clam-shell dredge, Wilmington, Del.....Dec. 6
Advertised, Eng. News, Dec. 6 to 20.
Dec. 28.Engineering supplies, Panama ....Dec. 13
Dec. 28.Ditch, Des Moines, Iowa..................Dec. 13
Dec. 31.Canal supplies, St. Catharines, Ont.....Dec. 20
Dec. 31.Telegraph poles, Montreal, Que..................Dec. 27
Jan. 2.Drainage ditch, Rosemond, Ill..................Dec. 27
Jan. 2.Tower clock, Brunswick, Ga..................Dec. 27
Advertised, Eng. News, Dec. 27.
Jan. 2.Pavilions, New York, N. Y..................Dec. 27
Jan. 2.Wharf repairs, Ft. Slocum, N. Y..................Dec. 20
Jan. 2.Wire, etc., Sweden (Foreign) ....Dec. 20
Jan. 5.Blasting, Portsmouth, N. H..................Dec. 13
Jan. 5.Subway, West Point, N. Y..................Dec. 27
Advertised, Eng. News, Dec. 20 to Jan. 3.
Jan. 5.Breakwater, Ottawa, Ont..................Dec. 27
Jan. 7.Pier, Nicolet, Que..................Dec. 20
Jan. 8.Naval supplies, Washington, D. C..................Dec. 20
Jan. 8.Dredging, New York, N. Y..................Dec. 6
Advertised, Eng. News, Dec. 6 to 27.
Jan. 9.Monument, Mt. Vernon, Ind..................Nov. 22
Jan. 9.Telephone supplies, Australia (Foreign)..Dec. 20
Jan. 9.Piling, Creston, Iowa ....Dec. 27
Jan. 10.Cement, Detroit, Mich..................Dec. 27
Jan. 10.Street railway franchise, Salem, Mass..Dec. 13
Jan. 11.Wharf work, Alaska..................Dec. 27
Jan. 12.Dredges, Panama ....Dec. 27
Jan. 12.Canal, Panama ....Dec. 20
Jan. 14.Telephone supplies, Australia (Foreign)..Dec. 20
Jan. 15.Crane runways, Callejo, Cal..................Dec. 13
Jan. 15.Surveying, sea marsh, N. Orleans, La.Dec. 27
Jan. 17.Wharf, Key West, Fla..................Dec. 6
Advertised, Eng. News, Des. 6 to Jan. 3.
Jan. 19.Wharf, New Orleans, La..................Dec. 27
Jan. 21.Dump scows, Cleveland, Ohio..................Dec. 20
Advertised, Eng. News, Dec. 20 to Jan. 10.
Jan. 29.Piers, North Chicago, Ill..................Dec. 13
Feb. 4.Grading electric railway, Bisbee, Ariz....Dec. 27
Feb. 11.Railway, Spain (Foreign) ....Dec. 6
Mar. 18.Tunnel, New Zealand (Foreign)..................Sept. 13
Advertised, Eng. News, Sept. 13 to Mar. 14.
Apr. 12 ('07).Ditches, Brookings, S. Dak..................Oct. 18

CIVIL SERVICE EXAMINATIONS.

Dec. 27.Surveyor, Philippines..................Dec. 6
Jan. 3.Aids, etc., Washington, D. C..................Dec. 13
Jan. 3.Civil Engr., Philippines..................Dec. 13
Jan. 8.Bacteriologist, New York, N. Y..................Dec. 20
Jan. 9.Topographic & Cartographic Draftsmen, Washington, D. C..................Dec. 13
Jan. 9-10.Computer, Draftsman, Wash., D. C..Dec. 13
Jan. 9.Arch. Draftsman, San Francisco, Cal...Dec., 20
Jan. 10.Inspector of Filters, New York, N. Y..Dec. 20

RAILWAYS.

ABBEVILLE & NORTHWESTERN.—Company has been chartered in Georgia to build its proposed lines from Abbeville to Fort Valley, Ga., 50 miles; capital $100,000. J. L. Bankston, G. B. Monroe, Hal Lawson and others, all of Abbeville, are the incorporators.

ATCHISON, TOPEKA & SANTA FE.—We are officially advised that authority has been granted for the construction of a new tunnel for the second track over the Raton Mountains, between Lynn, N. Mex., and Wootton, (Morley post-office), Colo., for the A. T. & S. F. Ry. Co. Tunnel is to be practically the same elevation as the old tunnel, but having a light grade through the tunnel. The total length of the tunnel will be 3,070 ft. Work will be started as soon as contract can be let and work pushed to completion. C. A. Morse, Topeka, Kan., is Ch. Engr.

BAUXITE & NORTHERN.—J. R. Gibbons, Supt., Bauxite, Ark., states that grading will begin about Jan. 1 on this road from Bauxite to Bauxite Junction, Ark., three miles. R. B. Mellon is Pres., Pittsburg, Pa. Noted on Nov. 22.

BLADEN & NORTHERN.—We are officially advised that company will let contracts this month for building its proposed line from a point near Stedman to White Oak, N. C., about 20 miles. Survey is made. Capital and right-of-way are being secured. Construction will be light. William Moncure is Ch. Engr., at Raleigh, N. C.; J. G. Shaw is Pres., Fayetteville, N. C.

BURR'S FERRY, BROWNDEL & CHESTER.—A. A. Brooks, Audr. and Pur. Agt., at Houston, Tex., advises us that contract for building from Aldridge to Browndel will be let soon. Company has completed surveys from Rockland, Tex., east via Browndel to Burkville, 52 miles. Right-of-way is partly secured. Work will be of a rough nature. The road has been constructed from Rockland to Aldridge, 7.7 miles. This line is projected from Chester, in Tyler County, Tex., east via Rockland and Browndel to Burrs Ferry on the Sabine River, about 80 miles. It is also proposed to extend line into the timber forests of Louisiana in the direction of Alexandria. John H. Kirky is Pres., Houston, Tex., and P. G. Omohondro is Ch. Engr., Beaumont, Tex.

CHARTIERS SOUTHERN.—Edward P. Taylor, Pres., Pittsburg, Pa., has stated that this company, recently chartered, proposes to build a railroad from Van Emman Station, Pa., on the Chartiers Railway, to a connection with the Ten Mile Run branch of the Pennsylvania R. R. near Lucile, Washington County, Pa., a distance of 18 miles. The location of the line is now being made. Thomas Rodd, Ch. Engr. of the Pennsylvania Lines West of Pittsburg, Pittsburg, Pa., will have charge of the construction.

CHICAGO & ILLINOIS WESTERN.—Work will begin on an extension from Hawthorne to Western Ave., Chicago, three miles, as soon as the necessary franchise is granted by the Chicago City Council. An extension from Willow Springs to Joliet, 25 miles, is proposed. O. P. Chamberlain is Ch. Engr., Chicago.

CHICAGO, MILWAUKEE & ST. PAUL.—We are officially advised by DITTMER, BRADBURY & WELTBREC, of Denver, Colo., who have contract for a 36-mile extension of the C., M. & St. P. from Lombard, Mont., easterly, including heavy work and eight tunnels, that they are now ready to let sub-contracts. Headquarters are to be established at Lombard. Free transportation for outfits and labor crews will be given over the Milwaukee system. Noted on Dec. 6.

DELAWARE & HUDSON.—We are officially advised that contracts will be let on Dec. 27 for straightening its tracks between Schenectady and Delanson, N. Y., 13 miles. A series of irregular curves and steep grades are to be removed, and a uniform grade established all the way. James McMartin, Albany, N. Y., is Ch. Engr.

LAS VEGAS & TONOPAH.—Arthur Maguire, Ch. Engr., Las Vegas, Nev., reports that this road is now completed from Las Vegas, Nev., where it connects with the San Pedro, Los Angeles & Salt Lake R. R., west to Rhyolite, Nev., 123½ miles, and that it is being extended from Rhyolite to Goldfield, 76 miles.

LOUISVILLE & EASTERN.—Company has awarded the contract for building the Shelbyville extension of its line, from Beechwood to Shelbyville, a distance of 23 miles, to W. L. LOVE, of Indianapolis, Ind. Beechwood is eight miles from Louisville on the Pewee Valley line. The work will cost about $500,000, as much of it is heavy construction. The contract calls for the completion of the work early next fall. Percy Moore is Pres. of the company, at Louisville, Ky.

NORFOLK & PORTSMOUTH BELT LINE.—The Norfolk Common Council and Board of Aldermen have voted in favor of an appropriation of $50,000 by the city for the extension of the Norfolk & Portsmouth Belt Line railroad across the eastern branch of the Elizabeth River to the mouth of Tanner's Creek, on Hampton Roads, a distance of about five miles. George S. Shafer is Supt., Norfolk, Va.

OKLAHOMA, TEXAS & GULF.—This company, which was recently incorporated in Texas, probably will ask bids next month for building its proposed line. The route is from Clarendon, Tex., through Balir, Roosevelt, Apache, Marlow, Ardmore and Lehigh, Okla., to Hope, Ark., approximately 350 miles. The work includes heavy trestle over North Fork and the Salt Fork of Red River. Noted on Nov. 22.

PORT ARTHUR & HOUSTON SHORT LINE.—C. S. Cleaver, Vice-Pres. and Gen. Mgr., La Porte, Tex., advises us that company will let contracts between Jan. 1 and Jan. 15, for construction of its line. As already noted, this company has made application to the Railroad Commission of Texas for authority to issue bonds in amount of $20,000 a mile on its proposed line. It will extend from Port Arthur, Tex., west via Hamshire, Wallisville and La Porte, to Houston, Harris County, 86 miles. Surveys have been completed and contracts made for the greater part of the right-of-way, depot and terminal grounds. This line passes through the richest portion of the rice belt of Texas. Its maximum grade will be 0.2%. Steel drawbridges will be required at crossings with Taylor and Cedar Bayous, and the Trinity and San Jacinto Rivers. F. J. Hart, St. Louis, is Pres.; H. Falkenberg is Ch. Engr., Port Arthur, Tex.

PORT O'CONNOR, RIO GRANDE & NORTHERN.—The Texas Railway Co. has filed an amendment to its charter in Texas, changing its title to the Port O'Connor, Rio Grande & Northern. The main line is changed to extend from Port O'Connor, Tex., through the counties of Calhoun, Victoria, DeWitt, Gonzales, Guadalupe and Bexar to San Antonio, Tex., a distance of 200 miles, passing through the towns of Seadrift, Victoria, Yoakum, Gonzales and Seguin. The following branches are provided for: From Gonzales to Smithville, through the counties of Gonzales, Fayette, Caldwell and Bastrop, a distance of 50 miles; from Yoakum to La Grange, through the counties of De Witt, Lavaca and Fayette, a distance of 61 miles; from a point on the main line 21 miles south of Yoakum, through the counties of Victoria and De Witt to Cuero, a distance of 20 miles, and from Seguin, through the counties of Guadalupe and Comal to New Braunfels, a distance of 17 miles. Grading is completed from Port O'Connor to Yoakum, 90 miles, and work is in progress from the latter point to Gonzales, 26 miles. W. S. HIPP, of Houston, Tex., has contract for about 265 miles of line, with 90 miles now being graded. The company is reported to have contracted with the CARNEGIE STEEL CO. for 19,000 tons of steel rails in addition to the 5,000 tons previously ordered. The bridge timber and ties are being shipped and preparations are being made to push the work of construction. The executive offices are located at San Antonia, Tex. M. Goggan, San Antonio, is Pres.; W. I. Allen, Victoria, Tex., First Vice-Pres. and Gen. Mgr.; George R. Gillette, San Antonio, Second Vice-Pres.; August De Zavala, San Antonio, Secy. and Treas.; L. A. Gueringer, Ch. Engr., Victoria.

TEMISKAMING & NORTHERN ONTARIO.—The Railway Commission has awarded the contract to JOHN CAHILL, Bonfield, Ont., for 275,000 railway ties.

The Ontario Provincial Government has decided to raise another loan for the completion of the Temiskaming & Northern Ontario R. R.

TEXAS RAILWAY.—The name of this road is changed to the Port O'Connor, Rio Grande & Northern by an amended charter filed in Texas. See Port O'Connor, Rio Grande & Northern.

VIRGINIA.—The McDermott Contracting Co., 1116 Pennsylvania Bldg., Philadelphia, announces that it has "good piece of railroad grading work to sublet, requiring traction shovel or scraper plants; about twelve miles from railroad in Charlotte County, Va., on Tidewater Ry." (Advertised, Engineering News.)

ELECTRIC RAILWAYS.

The names of parties awarded contracts are printed in capital letters.

BOSTON, MASS.—Stone & Webster, 84 State St., City, will organize a company to build a standard-gage electric railroad under the laws of Massachusetts, the name of the road to be the Boston & Providence Electric Railway Co., it is said. The line will extend 33 miles from Forest Hills to the town of Seekonk, on the boundary line between Massachusetts and Rhode Island, and will pass through the following towns: Hyde Park, Dedham, Westwood, Norwood, Canton, Sharon, Foxborough, Mansfield, Attleboro and Seekonk. The total capital stock will be $5,000,000. Russell Robb, Concord, Mass.; H. Huestis Newton, Everett; Frederic E. Snow, Boston; Frederick S. Pratt and James L. Richards, Newton, are interested.

PROVIDENCE, R. I.—The New York, New Haven & Hartford Railroad Co. will expend from $75,000 to $100,000 in completing the double-tracking of the Providence & Burrillville St. Ry., it is reported, between this city and Woonsocket, in order that it may be utilized to the fullest extent for carrying freight and handling passenger traffic. This move will be made both to relieve the freight congestion on the Worcester Division of the steam railroad and to give Northern Rhode Island fast electric service in carrying freight in this section. Willard Kent is Ch. Engr., and W. B. Nye is Supt., Woonsocket, R. I.

NEW ROCHELLE, N. Y.—Permission has been granted by the New Rochelle Common Council and the Village Trustees of Larchmont to the New York, New Haven & Hartford Railroad Co., according to the New York "Times," to widen its roadbed to accommodate eight tracks and to operate a trolley line between these points, completing the company's trolley circuit from the Harlem River to Boston. "The New Haven Road owns all trolley lines that run parallel to its own line from Larchmont to Boston. The officials have been figuring how they could connect their Larchmont, Greenwich and Stamford line with the proposed six-track electric route from New Rochelle to the Harlem River now in the course of construction. This stretch of road, which is the direct route, is held along the Boston Road by the Union Railway Co. The Union Co. has been using every effort to keep the Larchmont, Greenwich & Stamford Road from entering New Rochelle. According to the officials of the road, the company has already purchased the necessary right-of-way from the property owners, and work upon the new road will commence immediately. The two new trolley tracks will run directly alongside of the New Haven's present line, and are expected to be ready for service in the spring. Heavy cars for the new service from the New Rochelle station to Stamford, Conn., are now being built."

ROCHESTER, N. Y.—The State Board of Railroad Commissioners has denied the application of the Rochester, Corning & Elmira Traction Co. for a certificate of necessity to construct an electric line from Rochester to Elmira, about 120 miles. In denying the application, the majority of the board points out that the territory proposed to be benefited by the R., C. & E. Traction line is already served by one or more steam roads, one of which, the Board states, is electrifying its system between Rochester and Elmira.

DENVILLE, N. J.—The Morris County Traction Co. has been granted a 40-year franchise to build a connecting line between Denville and Boonton, N. J. Company has built 13 miles of electric railway in Dover, Rockaway, Wharton and Randolph Townships, as part of a continuous line to connect Madison with Lake Hopatcong. Company also has built ten miles from Summit to Elizabeth and Milburn. The completed line will be about 100 miles long. F. H. Alleman is Mgr., at Morristown, N. J.

BEAVER FALLS, PA.—Application will be made Jan. 7 for a charter by the Beaver Falls & New Castle Street Railway Co. The incorporators are C. J. D. Strowbecker and U. B. Duncan, of Zelienople; Jordan Johnson, of Hazel Dell; M. Bliss Dewey, of Jackson, Mich., and George B. Nye, of Ellwood. The proposed route is from Morado Park, at Beaver Falls, along the public road to Homestead, then through Big Beaver Township, this county, to Wampum. From Wampum the route runs northward to Mahoningtown.

BRUNSWICK, MD.—The Brunswick & Middletown Electric Railroad Co. has been incorporated with capital of $80,000, to build a line northward from Brunswick to Middletown, Md., ten miles, via Petersville, Burkittsville and Broad Run. The promoters are also interested in the Brunswick & Purcellville Railroad Co., which proposes to build a line between the two points named, 16 miles, Purcellville being in Virginia. The incorporators of the Brunswick & Middletown Railroad are William Schnauffer, Pres. of the Brunswick Savings Bank; Edward C. Shafer, Outerbridge Horsey, Alonzo P. Spritzer, Frank G. House, Levin West, Charles M. Huffer, Samuel Claggett, Charles J. House, Joseph D. Ahalt, Millard F. Cook and Dr. Arlington G. Horine.

NORFOLK, VA.—The Southern Branch Marine Railway, owned by Chas. J. Colonna, has been sold to George Roper, of this city, the purchase price being $90,000. There are two marine railways on the property purchased, one of which is operated by electricity and the other by steam. The former has a capacity of 600 tons and the latter 1,000 tons. Both railways are to be improved at a cost of several thousand dollars, and will be operated under the name of the Norfolk Marine Railway Co.

ROANOKE, VA.—The Roanoke Railway & Electric Co. proposes to spend more than $100,000 in the near future for various improvements, including extensions and double tracks, it is reported. J. W. Hancock is Gen. Mgr., at Roanoke.

WINCHESTER, VA.—The Winchester & Washington City Railway Co. is said to have secured the right-of-way between this city and Berryville, Clarke County, Va.

CHARLOTTE, N. C.—The Southern Power Co. has awarded the contract for building a railroad from King's Creek to the new power site at the Ninety-Nine Islands, on the Broad River, a distance of five miles, to STEWARD & JONES, contractors. According to the terms of the contract, work on this railway line is to commence at once. As soon as this road is finished, the work of developing this power will commence.

AIKEN, S. C.—James U. Jackson, of Augusta, Ga., Vice-Prest. and Genl. Mgr, of the Augusta & Aiken Electric Railway, is reported as saying that work will begin on the line to Columbia, 75 miles long, immediately after the holidays. Right-of-way has been secured and preliminary survey made. J. W. Wells, Augusta, is Ch. Engr.

COVINGTON, TENN.—Survey, plans, etc., for the proposed Memphis, Covington & Northern Railway have been completed by the W. K. Palmer Co., Dwight Bldg., Kansas City, Mo. Road is to be 39 miles long, extending from Memphis to Covington and beyond, and is to be part of a system of interurban lines around Memphis.

CLEVELAND, OHIO.—Bids will be received until Jan. 3 by Peter Witt, City Clerk, for a franchise to construct a street railway to be operated by electricity on portions of East 66th St., Storer and Trowbridge Aves. Noted on Dec. 13.

HILLSBORO, OHIO.—The Hillsboro, Bainbridge & Chillicothe Traction Co. is being organized to build an electric railway to connect the three towns named in the title. For the preliminary work the capital stock will be fixed at $50,000, but the intention is to turn it over to another corporation for financing, after this work is completed. George H. Smith, of Chillicothe; E. E. Rockhold, of Bainbridge, and James G. Steel, of Bourbonville, have been chosen as trustees to accept grants of right-of-way.

MIDLAND, MICH.—A franchise for an electric railway in Midland has been granted to A. W. Lewistein and Burton H. Carter, local capitalists. They are required to build the road within two years.

ST. PAUL, MINN.—The Board of Aldermen has granted the St. Paul City Railway Co. an extension of time until Dec., 1907, for the construction of the Dale St. cross line.

LINCOLN, NEB.—The City Council has passed an ordinance granting a franchise to the Lincoln Capital Beach & Milford Railway Co. to construct its railway over and across the viaduct on D St. and over and across certain streets in the city.

FORT SMITH, ARK.—Ira L. Reeves, Pres. of the United Cities Tra[illegible] Co., Reeves Bldg., Muskogee, Ind. T., [illegible]ces that the company will build four [illegible] of standard-gage electric railway at [illegible]ent. Work is to begin Jan. 1. Capi[illegible]00,000. The other officers are: H. G. B[illegible] Genl. Solicitor, Muskogee, Ind. T.; J. [illegible] Underwood, Secy., and J. T. Nelson, T[illegible] Fort Smith, Ark. Company wants pri[illegible] rails, ties, cars, spikes, bolts, fasten[illegible] poles, wire and all other materials for [illegible]lectric railway.

NIGHTHAWK, WASH.—A. [illegible] Dewey, of Spokane, has petitioned the County Commissioners of Okanogan County for right-of-way over certain highways [illegible] the county for an electric railway, which is to be 80 miles in length, and is to [illegible] south from Nighthawk to Brewster. At Nighthawk the proposed electric road is to connect with the Great Northern Railway, which is already graded to that point. At Brewster, to the south, it is to meet water transportation on the Columbia River. The towns on the proposed route are Nighthawk, Loomis, Conconully, Alma, Malott, Ophir and Brewster. Power for the proposed lines is to be developed on the Sinlebeloin River, where Mr. Dewey and his associates own seven miles of water rights and where 25,000 HP. can be developed.

PUYALLUP, WASH.—The Puget Sound Electric Co., of Tacoma, has applied to the City Council for a franchise for its proposed direct electric line between Tacoma and Puyallup. The proposed road will cost about $500,000, and is expected to be completed within a year. This company is allied with the Tacoma Railway & Power Co., of which W. S. Dimmock is Mgr. W. M. Bosworth is Engr., Tacoma, Wash.

SAN LUIS OBISPO, CAL.—The Board of Supervisors has granted a franchise to L. J. Beckett to construct and maintain an electric railway in San Luis Obispo County.

LOS ANGELES, CAL.—The Pacific Electric Co. has consented to build an extension to the Bimini Baths electric line on condition that a bonus of $15,000 be raised. This amount is now almost in hand, and it is expected that work will soon begin on the line. The new line will run from the present terminus at the Bimini Baths, in the northwestern part of the city, to Melrose Ave., and through Windermere Park, a new tract lying half a mile northwest of Bimini Baths. Geo. E. Pillsbury is Ch. Engr.

SAN BERNARDINO, CAL.—San Bernardino Urban Railway is the title of a company recently incorporated here by local capitalists to build an electric railway from this city to Rialto, Ontario, Riverside and Redlands. The capitalization is $1,000,000, of which $47,000 is subscribed by H. E. Harris, Victor Smith, A. G. Kendall, O. L. Moorman and S. S. Draper.

SAN FRANCISCO, CAL.—On Dec. 17 the Board of Supervisors adopted a resolution declaring its intention to proceed with the construction of an overhead electric trolley railroad, with modern equipment and appliances, on Geary St. from Kearny St. to Point Lobos Ave. and on Point Lobos Ave. to Tenth Ave., to Golden Gate Park. The clerk of the board was directed to prepare the resolutions and ordinances essential to carrying out this determination.

REDLANDS, CAL.—George H. Dunn and C. S. Chestnut have applied for franchises for electric railway lines in this city.

BISBEE, ARIZ.—Bids are asked by the Warren Co. until Feb. 4 for preparing the roadbed and sub-grade of approximately five miles of electric line for the Warren Co., between Bisbee, Ariz., and Warren, Ariz. Instructions to bidders, specifications, plans and profiles and other necessary information can be had upon application. Plans, specifications and profiles will be sent to competent bidders upon receipt of $25 as a guarantee for return of plans. Cleve W. Van Dyke is Mgr., Bisbee, Arizona.

WELLINGTON, NEV.—The Nevada, Mason & Los Angeles Railway Co. has been organized, with a capitalization of $1,000,000, and the following officers: Newton Evans, of Los Angeles, Pres.; J. I. Wilson, Vice Pres.; E. W. Fairbanks, Secy., and I. G. Kaufman, Treas. The company will build an electric railroad from Wellington to Wabuska, Nev. The line is to connect with roads running into Los Angeles. The power of the new road will be furnished by the Truckee River General Electric Co., of Reno.

EDMONTON, ALTA.—The ratepayers have voted favorably on a by-law to spend $119,000 on rails for the municipal street railway. (See Dec. 6.)

FORT WILLIAM, ONT.—The town will build an extension of seven miles to the municipal street railway system. The following supplies will be required: 750 tons of 60-lb. rails; 2,520 pr. 60-lb. angles; 7,560 lbs. of track bolts; 224 kegs of spikes; 2,520 copper bonds; 20 M. B. M. for culverts; 190,000 ties; 2,000 curve and guard rails; eight switches, complete; five railway crossings; two street railway crossings; 14,000 cu. yds. of excavation; 10,000 cu. yds. of gravel for ballast; seven miles of No. "O" trolley wire; seven miles of No. "O" feeder wire; 600 cedar poles. Bids for these supplies will be called for in a few weeks. Estimated cost of line, $83,000. A. McNaughton, Clerk.

LIGHT AND POWER PLANTS.

The names of parties awarded contracts are printed in capital letters.

CHITTENDEN, VT.—It is reported that the Rutland City Electric Co. will soon discard its steam plant and will operate its system from the hydro-electric plant at Chittenden. The steam plant will be kept intact to be used in case of emergency. A 500-KW. frequency changer set will be installed in the Cleveland Ave. sub-station about Feb. 1, when the entire work will be done by the water power plant. G. S. Haley is Mgr., Rutland, Vt.

LOWELL, MASS.—The Gas Commissioners have authorized the Lowell Electric Light Corporation to issue 2,800 additional shares of capital stock at $170. The proceeds to be used for additions and improvements. Stone & Webster, 84 State St., Boston, are Mgrs.

CENTRAL FALLS, R. I.—It is reported that the J. & P. Coats Thread Co. will erect a new electric power plant at Rand and Pine Sts.

DANBURY, CONN.—The Danbury & Bethel Gas & Electric Co. is contemplating the expenditure of $50,000 in the improvement of its gas and electric plant during the year 1907.

BUFFALO, N. Y.—The city has entered into a contract with the CATARACT POWER & CONDUIT CO. to supply the city with electricity to operate the electric motor and pump at the water-works for a period of two years at a flat rate of $3,125 per month, and to supply the same amount for the second pump when installed. The BUFFALO GENERAL ELECTRIC CO. has agreed to furnish the city departments as follows: For fire and police departments, 4 cts. per KW.-hour; Convention Hall, 6 cts.; the present maximum of 9 cts. to apply only to school and other buildings where the installations are small.

GLENS FALLS, N. Y.—According to press reports the Glens Falls Gas & Electric Light Co. has purchased the property and holdings of the United Gas & Electric Co., operating in Sandy Hill, South Glens Falls and Fort Edward. It is stated that the company will erect an electric power plant in Sandy Hill to supply Washington, Warren and Saratoga Counties with electricity and extend its lines to the several villages in these counties.

NEW YORK, N. Y.—The Brooklyn Rapid Transit Co. is completing plans for the largest and finest electric railroad powerhouse in the world. It is to be located on waterfront in Williamsburg. C. F. Baker is Supt. of Power, 85 Clinton St.

NEW HOLLAND, PA.—The BROWN ENGINEERING CO., of Erie, Pa., has been awarded the contract for the complete powerhouse to be erected here for Storb, Snader & Co., silk manufacturers.

PITTSBURG, PA.—C. Emil Mueller, Arch., 420 Wood St., has completed plans and will soon receive bids for the power-house of the Homeopathic Hospital on Center Ave. Estimated cost, $30,000.

SCRANTON, PA.—The Scranton Ry. Co. will erect a new power-house west of the Carbon St. bridge on the Lackawanna River.

WASHINGTON, D. C.—Bids are asked at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until Jan. 2, 1907, to furnish at the navy yards, etc., at Portsmouth, N. H., Boston, Mass., Newport, R. I., New York, N. Y., League Island, Pa., Annapolis, Md., Washington, D. C., and Norfolk, Va., a quantity of naval supplies, including the following: Schedule 314, armatures, electrical supplies; schedule 315, copper wire; schedule 317, electrical supplies, engine indicators, revolution counters. E. B. Rogers is Paymaster Gen.

SUFFOLK, VA.—The Suffolk Gas Co., which was recently incorporated to furnish fuel and illuminating gas, will erect a plant here at a cost of $120,000. A building 60 x 84 ft. is to be erected. W. H. Bonduran, 426 Walnut St., Philadelphia, Pa., is Engr.-in-Charge. J. A. Barham is Gen. Mgr.

HINTON, W. VA.—The Consumers' Light & Ice Co. has been incorporated with a capital of $75,000 to establish duplicate electric plants of 200-KW. each and a 30-ton ice plant. A 1-story building 65 x 140 ft. is to be erected. Estimated cost, $60,000. Wm. L. Fredeking is Pres; O. O. Cooper is Vice-Pres., and J. J. Duffy is Engr.-in-Charge.

WEST RALEIGH, N. C.—State Board of Agriculture has received from the Board of Visitors of the Agricultural and Mechanical College a recommendation to petition the Legislature for an appropriation of $50,000 to install a central power, light and heating plant at the college, replacing the five or six plants now in separate buildings. W. A. Graham, of Machpelah, N. C., was elected Chn. pro tem. of the Board.

ROANOKE RAPIDS, N. C.—The Roanoke Rapids Power Co. will erect a hydraulic power plant at Roanoke Rapids. A 2,000-ft. dam will be constructed across the Roanoke River and a power-house will be erected where 1,000 HP. will be developed. W. M. Habliston, Pres. of National Bank of Virginia, is Pres.

CRAWFORDVILLE, GA.—The city has voted to issue bonds for the construction of an acetylene gas plant.

BRYAN, OHIO.—An election will be held here on Dec. 27 to vote upon the question of issuing $40,000 of bonds, to be spent in the improvement of the municipal light and water plant.

TOLEDO, OHIO.—The Toledo Rys. & Light Co. contemplates the erection of a substation at a cost of $30,000 on its property on Central Ave., to furnish light and power to Auburn Ave.

CLEVELAND, OHIO.—Bids are asked until Dec. 28 by the Board of Public Service for furnishing, lighting, extinguishing and keeping in repair, including the furnishing of electricity and all materials necessary therefor, about 1,300 electric arc lamps for a period of one year from Jan. 1, 1907. A separate bid will be made for each of two districts, one comprising all the territory in the city west of the Cuyahoga River, requiring about 350 lamps, and the second all the territory east of the Cuyahoga River, requiring about 950 lamps. A. R. Callow is Secy.

KNIGHTSTOWN, IND.—The City Council is reported to have voted to install a new 300-HP. gas engine in the electric light and water-works plant. Other equipment will also be added, as the present plant is inadequate to the demands upon it.

BAY CITY, MICH.—The Tittabawassee Power Co., capitalized at $1,000,000, has filed articles of association in Midland County, for the purpose of building dams and utilizing the power of the water of the Tittabawassee River at Edenville. George G. Prentis, of Detroit, Mich., is one of the incorporators.

COOPERSVILLE, MICH.—The Village Council is reported to have closed a contract with the GRAND RAPIDS MUSKEGON WATER POWER CO. to light the streets of the village. The contract calls for about 40 100-cp. lamps. The company also will furnish commercial lighting and power to manufacturing plants.

MARQUETTE, MICH.—It is proposed to remodel the municipal electric light plant by constructing a new station, installing a larger generator and extending the flume, at a cost of $97,000. Charles Retallic is Supt.

CEDARBURG, WIS.—The Milwaukee Northern Electric Ry. Co. contemplates the erection of a power-house and car barns here.

FREMONT, NEB.—The City Water & Electric Light Co.'s plant is to be improved at a cost of $75,000. J. H. Mathews is Mgr. and Supt., at Fremont. C. A. Chapman, Monadnock Block, Chicago, is Engr.

EXCELSIOR SPRINGS, MO.—The Excelsior Springs Light, Power, Heat & Water Co. will double the capacity of its plant. A new unit of 150 KW. capacity will be installed, for which the contract has been awarded.

JEFFERSON CITY, MO.—Warden Hall of the Missouri penitentiary will ask the Legislature to appropriate $150,000 for the purpose of building a new power plant.

FORT SMITH, ARK.—The United Cities' Traction Co., which was recently incorporated with a capital of $100,000 to construct a street railway, will also erect an electric light and power plant. Ira L. Reeves is Pres.; H. G. Baker, Vice-Pres.; J. W. Underwood Secy., and J. T. Nelson is Treas.

ALAMEDA, CAL.—It is reported E. E. Calvin, Gen. Mgr. of the Southern Pacific Co., announces that plans have been completed to electrify both of the local lines of the Southern Pacific Co. and also the line which runs from the Alameda mole and terminates at Fourteenth and Franklin Sts., Oakland. The plans call for the construction of a large power house at Alameda Point. It is also planned to electrify the Encinal Ave. line, from the Alameda mole to High St., and the Lincoln Ave. line, from the Alameda mole through this city out to Melrose. The cost of the work is estimated at $1,126,695. The next step will be the electrification of the Oakland system, which the officials announce will follow in a short time after the Alameda system has been completed.

PASO ROBLES, CAL.—It is reported that the question of erecting a municipal water and light plant is now being considered in this town. At a meeting of the citizens held recently it was decided to request the City Trustees to secure the services of an engineer to make an estimate of the cost of a plant.

SAN DIMAS, CAL.—It is reported that a dam is to be built across the Puddlestone Wash, near here.

SALT LAKE CITY, UTAH.—Plans are being prepared by the Utah Light & Rys. Co. for extensive improvements to its electric light and power plant.

SALT LAKE CITY, UTAH.—Gaylie R. Cleveland, 464 East Sixth St., South, Salt Lake City, has applied to the State Engineer for 7 cu. ft. of water per second to be diverted from the Jordan River, in Utah County. The water will be taken for the purpose of generating power for electrical purposes in American Fork Canon and Alberta. The plans include a diverting channel of 6,000 ft. and two Pelton wheels and other machinery sufficient to generate 400 HP.

The Utah Light & Railway Co. is extending its transmission lines to Huntington. It is estimated that the company will expend more than $200,000 in this county during the next year. The company will soon extend its line to North Ogden and the Utah Hot Springs. O. N. Honnold, of this city, is Ch. Electrical Engr.; R. S. Campbell is Mgr.

A permit has been granted to the Salt Lake Public Service Co. to erect a brick power-house on Third West St., which will cost about $45,000.

OTTAWA, ONT.—The civic electric lighting plant will be extended and improved at a cost of $50,000.

COBALT, ONT.—A company is being formed for the purpose of developing 40,000 HP. on the Quinze River, at the head of Lake Temiskaming. The power will be used for mining purposes in the Cobalt region, which is only 18 miles away, and also for lighting purposes, and for an electric railway to run from New Liskeard to the source of the power, and thence to the foot of Quinze Lake, on which it is proposed to run a line of steamers to forward supplies for the construction of the Grand Trunk Pacific. There will also be ample power to run a large pulp and saw mill on the Quinze River. P. J. Loughrin, of Toronto, is for the present acting as Secy.

WINNIPEG, MAN.—It is reported that Cecil B. Smith, the civic power expert, states tenders will be called early in February for the construction of the power plant to be erected on the Winnipeg River at a cost of $3,600,000. The plant involves the building of a transmission line 80 miles long, also several sub and distributing stations.

PRINCE ALBERT, SASK.—It is reported that Charles B. Mitchell, C. E., engaged by the town to report of the development of power, states 1,500 electrical HP. can be developed in the Shell River at a cost of $150,000. In the Saskatchewan River 10,000 HP. can be produced for $350,000 and with an outlay of $1,000,000 for a dam on the same river, 100,000 can be secured.

BRIDGES.

The names of parties awarded contracts are printed in capital letters.

FALL RIVER, MASS.—We are officially advised that on Dec. 13 bids were received by Frederick N. Wales, Clk. Joint Bd., State House, Boston, for constructing a 920-ft. steel drawbridge on concrete foundation between Fall River and Somerset, over the Taunton Great River. Following are the bids for (a) building two abutments with foundations, five piers with foundations and guard piers at draw-span; (b) for erecting draw-span and five fixed spans; (c) for building floor of fixed spans (no bids submitted); (d) for grading and finishing the approaches, with gutters, curbstones, sidewalks, etc.; (x) for entire work: HOLBROOK, CABOT & ROLLINS CORPORATION, 6 Beacon St., Boston (awarded contract) (a) $420,000, (d) $70,000, (x) $770,000; Penn Bridge Co., Beaver Falls, Pa., (b) $235,900; James F. Keon, 121 Clifton St., Boston, (a) $450,000; New Jersey-West Virginia Bridge Co., Fuller Bldg., New York, N. Y., (b) $260,788; United Construction Co., Albany, N. Y., (b) $236,175; Eastern Steel Co., Pottsville, Pa., (b) $263,000; New England Structural Co., 110 State St., Boston, Mass., (b) $217,500; Boston Bridge Works, 47 Winter St., Boston, Mass., (b) $219,985; King Bridge Co., Cleveland, Ohio, (b) $232,000; Pennsylvania Steel Co., Mason Bldg., Boston, Mass., (b) $232,000; Berlin Construction Co., Board of Trade Bldg., Boston, Mass., (b) $230,900; Patrick McGovern, 9 Beacon St., Boston, Mass., (a) $435,000, (d) $65,000.

CAMBRIDGE, MASS.—Bids are asked until noon, Jan. 16, by L. M. Hastings, City Engr., City Hall, Cambridge, for constructing complete steel highway draw-bridge across Lechmere Canal, Cambridge. This is an extinsion of time from Jan. 2, as previously advertised. (Advertised, Engineering News.)

SOUTH WINDHAM, CONN.—The town has voted an appropriation of $6,000 for a new steel bridge over the Shetucket River to replace the old structure at this site. It is only necessary to wait for a second town meeting to ratify this vote before the contract may be awarded.

NEW YORK, N. Y.—On Dec. 13 the bids for constructing steel work on the Long Island City approach of the Blackwell's Island bridge were received by J. W. Stevenson, Comr. of Bridges. The lowest estimate is that of the Buckley Realty & Construction Co., Times Bldg., New York, whose figure is $797,804. The next lowest bid was made by the Snare & Triest Co., 143 Liberty St., New York, builders of the new Flushing bridge. Their estimate was $885,830, almost $90,000 higher than the other. The highest estimate was made by the King Bridge Co., 277 Broadway, New York, $1,157,443. The other estimates are as follows: American Bridge Co., 42 Broadway, New York, $918,008; Carbon Steel Co., 26 Cortlandt St., New York, $945,319; Terry, Trench & Co., Lexington Ave. and 131st St., New York, $919,500; Williams Engineering & Contracting Co., 13 Park Row, New York, $1,035,592. The contract calls for construction of the Queens approach to the bridge, and according to the terms of the specification the entire work must be completed within a year. For the faithful performance of the contract the successful bidder is required to furnish security in the sum of $200,000. The approach to the bridge is to be a steel viaduct 1,500 ft. in length. According to the engineers of the Bridge Department, it is the last connecting link of steel work that is required in the construction of the bridge on the Queens side of the river. All the rest of the construction will be masonry work connecting with this steel approach and providing direct access to the bridge.

NIAGARA, N. Y.—The following are interested in the Frontier Bridge Co. which is applying for permission to bridge the Niagara River: J. P. Murray, A. E. Osler, Toronto; F. A. Hilton, 608 Ellicott Sq., Buffalo, N. Y.; W. G. Burlston, T. H. Taylor, B. Van Horne, Niagara Falls, N. Y.

LOGAN (Philadelphia post-office), PA.—About $100,000 will be expended by the Philadelphia & Reading Ry. Co. on a new bridge at Logan. It will span Broad St., Old York Road, which is to be widened 10 ft. on the east side, and Lindley Ave., which is to be opened through, intersecting at right angles the other two streets. The new bridge will be of the through plate-girder type, and is designed to carry four tracks, it being the plan of the company to four-track its line from Wayne Junction to Newtown Junction, where the New York Short Line branches off. Across Broad St. the new bridge will be constructed of girders 100 ft. long and 10 ft. high, each weighing 66 tons. The girders over Old York Road will be 62 ft. long. William Hunter, Philadelphia, is Ch. Engr.

PITTSBURG, PA.—Bids are asked by E. M. Wilkins, Supt. Bureau of Construction of Pittsburg, for a 186-ft. skew span to be erected to carry two street railway tracks over a hollow of the Pennsylvania Railroad.

At Pittsburg, a contract for three steel bridges on the West Side Belt R. R., to cost about $150,000, has been awarded to the AMERICAN BRIDGE CO., of Pittsburg (New York office, 42 Broadway). Work is to be started immediately. These bridges will be built on that portion of the terminal line between its junction with the Wabash-Pittsburg Terminal Ry. on the south side of Duquesne Heights and its junction with the Pittsburg & Lake Erie R. R. at Saw Mill Run, in the West End. They will have two tracks and will replace the single-track wooden structures now in use. H. J. Douglas, Jr., Pittsburg, is Ch. Engr.; B. Blickensderfer, Canton, Ohio, is Consult. Engr.

NORFOLK, VA.—The amended plans of the proposed Norfolk & Southern R. R. bridge across Albemarle Sound to connect Edenton with Mackie's Ferry, have been received at the local office of the company from the War Department marked approved. This means that the Norfolk & Southern R. R. Co. has secured the permit to build the structure, which is to be over five miles in length. The amended plans call for two draw openings, each 160 ft. in width. J. A. Barron, Berkley, Va., is Supvr. of Bridges and Bldgs.

COLUMBUS, GA.—The Bridge Committee of the City Council has recommended the erection of a modern steel bridge across the Chattahoochee River in the place of the present wooden structure at Dillingham St. W. C. Campbell is Supt. Pub. Wks.

DEMOPOLIS, ALA.—The Demopolis Improvement Co. has been organized here with a capital of $25,000 for the purpose of constructing a steel bridge across Black Warrior River, here. The incorporators are: John C. Webb, Pres.; John C. Webb, Jr., Vice-Pres.; Benjamin F. Elmore, Secy. and Treas., all of this city. The main span of the bridge will consist of a draw with an extreme length of 341 ft., at each end of which there will be a 54-ft. span and a steel tower of 18 ft., making the total length of the steel structure 486 ft. A trestle will continue from each end on easy grade to the ground. These trestles will be 180 and 200 ft. in length, respectively, making the total length of the bridge 865 ft.

MEMPHIS, TENN.—Bids are asked until Jan. 16 by the Board Fire and Water Commissioners at the office of Ennis M. Douglas, City Register, for furnishing material and erecting a steel girder bridge at Madison Ave. over the Southern Ry. tracks.

The County Commissioners on Dec. 10 are reported to have decided to ask for bids for rebuilding the steel bridge on the Memphis and Cuba road. The bids are to be submitted for the erection of a steel structure on the old site and also one mile further east, at which is known as the Rice Mill site. The bids for the latter will also include building a levee from Hatchie Hill to the old mill site.

CARTHAGE, TENN.—The contract for construction of the proposed bridge across the Caney Fork River, between this city and Elmwood, has been let to the W. T. YOUNG BRIDGE CO., of Nashville, Tenn., at $14,695. The new bridge will be three miles from here and two miles from Elmwood. Bids were received Dec. 15.

WEST POINT, KY.—We are officially advised contract for reconstructing draw bridge over Salt River, near West Point, for the Louisville, Henderson & St. Louis Ry. Co., as noted in Engineering News, Dec. 6, has been let to the LOUISVILLE BRIDGE & IRON CO., of Louisville. The pivot pier will be rebuilt by the railway company's forces. The bridge will be 340 ft. long and 19 ft. wide. The estimated costs of substructure are $35,000 and $25,000, respectively. The original bridge was recently destroyed by flood. L. M. Cox, Louisville is Ch. Engr.

YOUNGSTOWN, OHIO.—Plans of H. M. North of Cleveland, Ohio, Asst. Engr., Lake Shore & Michigan Southern Ry. Co., for the elimination of the Oak St. and Valley St. grade crossings have been referred to the City Council. The plans contemplate construction of two overhead bridges, the Oak St. bridge to be 550 ft. long and to cost $150,000, and the Valley St. bridge to be 500 ft. long and to cost $90,000. F. M. Lillie is City Engr.

SPRINGFIELD, OHIO.—The Board of Public Service proposes to construct next year a bridge over Buck Creek, connecting Sherman Ave. and Nelson St., and will ask an appropriation of $25,000 for that purpose.

TOLEDO, OHIO.—An ordinance was introduced in council on Dec. 10, authorizing the Directors of Public Service to build a new bridge over the canal at South Ave. The structure is not to cost more than $30,000. F. I. Consaul is City Engr.

INDIANAPOLIS, IND.—Bids are asked until Dec. 29, by the County Commissioners for constructing bridge at 13th St. over White River in Riverside Park. It will have three spans, will be 70 ft. wide in the clear and about 400 ft. long. It will be a Melan arch concrete structure, but all parts that show will be faced with granite. The bridge will be built about 200 ft. south of the present structure at 13th St., and thus the present bridge will be used during the construction of the new one.

ROCKVILLE, IND.—Bids are asked by the Commissioners of Parke County, until 1 p. m. Dec. 29, for construction of an approach to bridge across Wabash River.

NEWPORT, IND.—We are officially advised that JAMES F. PIERCE of Delphi, Ind., has contract for constructing highway bridge over the Wabash River at Newport. Cost, $22,518. H. T. Payne is County Audr. Bids were received Dec. 15.

URBANA, ILL.—Bids are asked until Jan. 3, at the Court House, for construction of a 170-ft. span highway bridge on concrete abutments, at Urbana. Ira O. Baker, Ill., is Engr.

CRESTON, IOWA.—Bids are asked until Jan. 9 by the Board of County Supervisors, for furnishing material and constructing all bridges required to be built in this county during the year 1907. W. F. Craig is County Audr.

MINNEAPOLIS, MINN.—By an agreement recently completed, the Northern Pacific Ry. Co. and Great Northern Ry. Line will reconstruct bridge at 29th and University Aves. Northeast, in Minneapolis, without waiting for the Supreme Court decision as to whether the railroads or the city must stand the expense. The Northern Pacific submitted a formal offer agreeing to pay the amount of $18,000 which the city engineer has named as that company's share of the expense. It is stipulated in this offer that the Great Northern shall be permitted to do its part of the work at the same time, and as the latter road has already agreed to advance its part of the money the work may now proceed. G. A. Casseday is Bridge Engr., Great Northern, at St. Paul; L. Yager, Minneapolis, is Supv. Bridges and Bldgs, Northern Pacific.

WICHITA, KAN.—Bids are asked by the County Commissioners, until Jan. 12, for construction of the following bridges: Pile bridge, 156 ft. long, 16 ft. wide over the north branch of the Ninnescah River; pile bridge, 230 ft. long, 16 ft. wide over the south fork over the same stream; pile bridge 60 ft. long, 16 ft. wide over Cowskin Creek; steel bridge 60 ft. long, 16 ft. wide over Chisholm Creek.

FREMONT, NEB.—Bids are asked until noon, Jan. 9, by C. O. Boe, County Clk., for construction of bridges in Dodge County, during the year 1907. A. P. Shephard is Chn. County Bd. Supvs.

ST. LOUIS, MO.—A plan has been submitted to the St. Louis Municipal Bridge and Terminal Commission for the improvement of the east approach to the Eads bridge by construction of a wagon viaduct with laterals leading to all the railroad freight houses on the island.

TEXARKANA, TEX.—A bridge will be erected for Bowie County across Aiken Creek. Bids for same will be received soon. B. F. Hargett is Commr. Precinct No. 1, Bowie County.

COLFAX, WASH.—Bids are asked until Jan. 15, by the County Court for constructing three bridges in Whitman County.

GILROY, CAL.—The contract for constructing concrete bridge over Coradero Creek at Gilroy has been awarded to JOHN McREYNOLDS, of San Jose, at about $13,000. J. G. McMillan is County Surv., San Jose.

TOMBSTONE, ARIZ.—Plans and specifications in detail will be received by the Board of Supervisors until Dec. 28, for construction and completion of a steel bridge across the San Pedro River, with concrete piers and frame approaches at a point about one-half mile north of the Southern Pacific Ry. bridge. J. J. Bowen is Chn.

APPIN, ONT.—It is reported that a bridge to cost $15,000 will be constructed at Appin.

PETERBORO, ONT.—The council is about to arrange for the building of four steel bridges across the river here. Address the Mayor.

WINNIPEG, MAN.—The contract for constructing steel superstructure of highway bridge over Red River at Redwood Ave. has been awarded to THE DOMINION BRIDGE CO., of Montreal, Que., at $88,800.

The Provincial Government has granted the request of Winnipeg and St. Boniface for a grant of $125,000 for building a bridge between the two cities. H. N. Ruttan is City Engr., Winnipeg.

BUILDINGS.

BOSTON, MASS.—Rollin H. Allen, 240 Commonwealth Ave., City, will erect a theater and office building at Boylston and Exeter Sts. Clarence H. Blackall, 20 Beacon St., is Arch. The building will cost about $1,000,000.

BUFFALO, N. Y.—Bids are asked until 3 p. m., Jan. 4, by James Knox Taylor, Supervis. Arch., Treasury Dept., Washington, D. C., for the renovation of the plumbing system, etc., in the U. S. Post-Office Building.

Bids are asked by Francis G. Ward, Comr. Public Works, until 11 a. m., Jan. 4, for the erection of a 3-story brick addition to the present Central High School building, at Franklin and West Genesee Sts., as follows: Masonry, cut stone, iron work, plastering, etc.; carpentry, painting, glazing, hardware, etc.; roofing, metal work, steel ceilings, etc.; heating, ventilating, etc.; plumbing, gas-fitting, etc.; electrical work, etc.

Rev. James F. McGloin, pastor of the Chapel of the Blessed Sacrament, has received from architects in Rome plans for a new cathedral which the church proposes to erect at a cost of about $500,000. The new building is designed to hold 1,500 people. Bishop Charles H. Colton may be addressed at 1025 Delaware Ave., Utica.

SYRACUSE, N. Y.—The North Side High School Commission has decided to advertise immediately the contract for the proposed new high school building. Bids will be opened Jan. 3. The cost will be about $200,000. Russell & King are Archs.

NEW YORK, N. Y.—Plans have been filed for the first of the passenger stations in Boro. of Manhattan for the North River tunnel of the New York & New Jersey Railroad Co., to be built at 683 and 685 Greenwich St., with an "L" on Christopher St. It is to be of brick trimmed with limestone, five stories high, and have a frontage of 41 ft. and a depth of 86 ft., with an extension. It will be known as Sub-station No. 1, and will cost $68,000.

WM. J. TAYLOR, 5 East 42d St., has the general contract for the apartment building, at 67th St. and Lexington Ave., for the Sixty-seventh Street Studios, 23 West 67th St. Plans drawn by Rossiter & Wright, 110 East 23d St. Eleven stories, 90 × 170 ft., brick and stone, fireproof construction. Cost, about $750,000.

The award in the architectural competition for the new buildings of the Union Theological Seminary has been made to Allen & Collens, 6 Beacon St., Boston; 35 firms submitted plans. In addition, awards of $800 were made to four firms, whose plans were judged to be next best. A payment of $800 each was made to four other firms especially invited to take part. The new buildings of the seminary are to be erected on the property, at 120th to 122d Sts., Broadway and Claremont Ave.

Bids are asked by C. B. J. Snyder, Supt. School Bldgs., Bd. Education, until 11 a. m., Jan. 7, for the general erection of new public school No. 155, at Herkimer St. and Eastern Parkway, Boro. Brooklyn. Also for equipment on other contracts.

Bids are asked by John W. Brannan, Pres. Bd. Trustees, Bellevue and Allied Hospitals, until 3 p. m. Jan. 8, for erection and completion of new training school for women nurses, Bellevue Hospital, East River and 25th and 26th Sts.

NEW YORK, N. Y.—Bids were opened Dec. 21, at the office of the Supervising Architect of the Treasury, Washington, D. C., for installing a vacuum cleaning system in the New York Custom House. Bids were as follows: Vacuum Cleaner Co., New York, $7,725, May 15, 1907; John S. Thurman for the General Compressed Air House Cleaning Co., St. Louis, $6,492, March 30; Blaisdell Machinery Co., Bradford, Pa., $5,800, March 15; Sanitary Devices Mfg. Co., New York, $5,700, alternate $5,600; March 20; Baldwin Engineering Co., New York, $7,500, May 20.

Bids were received as follows on Dec. 17 by Theodore A. Bingham, Police Comr., for new station-house, prison and stable for 19th Precinct on 30th St., east of Seventh Ave.: D. J. Ryan, 723 Third Ave., $200,400; L. Wechsler, 1135 Broadway, $206,700; P. Gallagher, 1189 Broadway, $204,869; Kelly & Kelley, Inc., 45 East 42d St., $218,934; Thos. G. Carlin, 215 Montague St., Brooklyn, $212,221; Jno. Kennedy & Co., 1133 Broadway, $199,895; Waters & O'Connell, 103 East 125th St., $198,900; A. Nugent & Son, 103 East 125th St., $208,500; R. E. Heningham, 1 Madison Ave., $205,976; T. T. Nesbitt Co., 116 Nassau St., $198,000; J. & L. Moreland Co., 1910 Park Ave., $215,970; Jas. T. Kerr, 205 West 30th St., $198,879; P. J. Brennan & Son, 949 Broadway, $209,300; J. H. Parker Co., 225 Fourth Ave., $209,985; Ed. D. Broderick, 1382, Lexington Ave., $219,970; Thos. B. Leahy Bldg. Co., 1 East 42d St., $229,987.

NEW YORK, N. Y.—Bids were received by Board of Education for installing heating and ventilating apparatus in public school No. 90, on 147th and 148th Sts., near Seventh Ave. The James Curran Mfg. Co., 512 West 36th St., was lowest bidder, at $60,182. This company was also the lowest bidder for installing heating and ventilating apparatus in addition to public school No. 121, on 103d St., west of Second Ave., at $15,500.

GENEVA, N. Y.—The Board of Trustees of Hobart College will found a woman's college in connection with Hobart. It will have an endowment of $350,000 and will be called William Smith College for Women. Two buildings will be erected.

TRENTON, N. J.—The Mayor has signed the ordinance providing for the new $300,000 city hall. The commission has organized by electing F. W. Roebling, Pres.; C. Edward Murray, Secy., and J. H. Blackwell, Treas. Sites are now being considered.

PHILADELPHIA, PA.—JOHN R. WIGGINS, 1215 Filbert St., City, has been awarded contract for erection of new municipal hospital for contagious diseases at Hunting Park Ave. and Second St. Bid was $679,382.

PHILADELPHIA, PA.—Watson, Huckle & Co., 1211 Walnut St., City Archs., have been commissioned to prepare plans for a garage to be erected at 216-18-20 North Broad St., for the Keystone Motor Car Co. The building will be four stories high, of reinforced concrete construction, with an exterior wall of stone and terra cotta. The area to be covered measures 53 × 200 ft. The ground on which the building will be erected was purchased for $125,000.

PITTSBURG, PA.—The Jones & Laughlin Steel Co. will erect a 15-story building between South 26th and South 27th Sts., on the south side of Carson St., which, besides containing the offices of the company, will also be a large department store, which will take the place of the present company store. The company recently bought a large tract of land at Aliquippa and is preparing to erect mills at an expenditure of $7,000,000. The RITER-CONLEY CO. has been awarded the contract for four blast furnaces and work on these will start at once.

ALLEGHENY, PA.—Plans for the proposed freight station of the Pennsylvania lines in Allegheny are being discussed by the Allegheny Council. The building will cost $500,000 and the contract will be awarded about Jan. 1. Thos. Rodd is Ch. Engr., Pennsylvania lines west, Pittsburg, Pa.

BALTIMORE, MD.—Haskell & Barnes, Archs., Wilson Bldg., 301 North Charles St., have prepared tentative plans for dormitory building to be erected at Lombard and Greene Sts., for the University of Maryland.

WASHINGTON, D. C.—Elliott Wood, Supt. of the U. S. Capitol Buildings and Grounds, Washington, D. C., has awarded to the AMERICAN BRIDGE CO., Baltimore, Md., contract for the steel framing for the Senate office building, at $39,990; 2.18 cts. a lb. for plain shapes; 2.30 cts. a lb. for shapes punched; 2.50 cts. a lb. for shapes punched and fitted.

The committee in charge of construction of the Reform School Building, Washington, D. C., has awarded to RICHARDSON & BURGESS, Colorado Bldg., Washington, D. C., contract for the construction of the new buildings at that institution, at $92,277.

Competitive plans are being prepared for a new assembly or amusement hall, to be erected at the Government Hospital for the Insane. It will be fireproof in construction; seating capacity, 1,000. Cost, $75,000. Drawings will be submitted Jan. 10.

MIDDAUGH & SHANNON, 2405 First St., N. W., will erect 24 2½-story brick and frame dwellings with hot-air heating systems at 434-444 Park Road and 435-469 Luray Place, to cost about $75,000. Joseph Bohn, Jr., Stewart Bldg., City, is Arch.

HARRY WARDMAN, 717 14th St., N. W., will erect three apartment houses at 1757 1761 Columbia Road, N. W. Three stories, 40 × 71 ft. Cost, about $80,000. A. H. Beers, 717 14th St., N. W., is Arch.

WASHINGTON, D. C.—Bids are asked until noon, Jan. 5, for improvement of Street Cleaning Department stable, in alley between N and O and Ninth and Tenth Sts., N. W. Henry B. F. Macfarland, Henry L. West and John Biddle, Comrs. (Advertised, Engineering News.)

NORFOLK, VA.—The School Board has asked the Councils for an appropriation of $150,000 for a new high school building. The matter is in the hands of Geo. L. Arps, Chn., W. L. Northern and T. S. Fitzgibbon, the Committee.

A cottage city is to be constructed in the suburbs of Norfolk to accommodate 1,000 guests to the Exposition. The buildings will be permanent structures, operated during the Exposition from a central office on a hotel basis. After Exposition they will be converted into modern residences. F. J. Killam is at the head of the enterprise.

The Hotel Powhatan, containing 250 rooms, will be constructed at foot of Plume St. Plans are being made by Neff & Thompson, Archs., Withers Bldg., City. The syndicate is headed by R. Randolph Hicks, T. J. Wool, A. F. Butt and A. E. Warner.

MONROE, N. C.—The Seaboard Air Line Railway is reported to be having plans prepared for a $60,000 freight station and transfer plant here. W. L. Seddon, Portsmouth, Va., is Ch. Engr.

CHARLOTTE, N. C.—It is reported that the Charlotte Realty Co. has purchased the Osborne property, 64 × 99 ft., at $92,000, and will erect a 10 or 12-story steel frame office building on the site, costing between $150,000 and $225,000.

BRUNSWICK, GA.—Bids are asked until Jan. 2, by the Commissioners of Glynn County for installing a tower clock in County Court-House. Charles A. Gifford and Edward S. Betts, Associated Archs., 18 East 17th St., New York. J. J. Lott, Chn., Brunswick. (Advertised, Engineering News.)

NEW ORLEANS, LA.—Dr. L. Williams, 1331 St. Charles Ave., has bought the Coliseum Hotel property, at Race and Coliseum Sts., and is now considering plans for building thereon a 6-story family hotel, which will contain about 300 rooms.

The Court-House Commission, Bernard McCluskey, Pres., 1201 Hibernia Bank Bldg., will receive bids Feb. 4 for the erection of a 4-story fireproof court-house, 250 × 290 ft. Pile foundation, exterior of stone and terra cotta; electric elevator and wiring; heating system. Proposals are invited for both steel and reinforced-concrete frame and floor construction. Plans and specifications may be seen at office of the Commission, 1201 Hibernia Bank Bldg., and copies may be secured at the offices of Frederick W. Brown, A. Ten Eyck Brown and P. Thornton Marye, Associated Archs., Equitable Bldg., Atlanta, Ga., upon request, accompanied by a deposit of $25, of which $15 will be refunded on return of plans and specifications. Arthur McGuirk, Secy., Court-House Commission, Hibernia Bank Bldg., New Orleans, La.

SHREVEPORT, LA.—Bridges & Snyder, First National Bank Bldg., City, are Archs. for proposed bank and office building for the Continental Bank & Trust Co. It will be of steel construction, 70 × 150 ft., six stories high. Cost of building, $125,000; equipment, $15,000. Bids will be received on Jan. 14. Steel is already purchased.

CLEVELAND, OHIO.—A 99-yr. lease of the property at the southeast corner of Bolivar Road, S. E., and East Ninth St. has been obtained by Saul Feigenbaum, and the Utica Bldg., now located on the site, will be converted into a modern stag hotel building. The property was leased to Mr. Feigenbaum by W. R. Lincoln. A stock company, now being formed, will take up the hotel project. The building will cost from $300,000 to $500,000.

CONNEAUT, OHIO.—The Board of Education wants preliminary sketches for a high school building, to cost from $80,000 to $100,000. F. F. Rieg is Clk.

HAMILTON, OHIO.—Moses Mosler, safe manufacturer, has purchased the old Lowman homestead, at North Crescent Ave. and Reading Road, Avondale. The property has a frontage of 300 ft. on Reading Road and is about the same in depth. Mr. Mosler has decided to build an apartment house, containing a number of flats and an office on the ground floor.

CINCINNATI, OHIO.—A Catholic Cathedral to cost $1,000,000 is to be erected here. On a 10-acre tract of land given for the purpose north of Norwood it is proposed to erect the new cathedral, a seminary building costing about $175,000, a cathedral home for the archbishop costing $50,000, a parish priest's house, a school and a teachers' house. It is planned to have the buildings face a boulevard 100 ft. wide and lined with shade trees. The site is known as Norwood Heights.

SOUTH BEND, IND.—The Trustees of the Y. W. C. A. will soon ask for bids for the erection of a Home for Young Girls. Mrs. J. B. Reynolds is Secy.

CRAWFORDSVILLE, IND.—Bids are asked until 3 p. m., Jan. 31, by James Knox Taylor, Superv. Arch., Washington, D. C., for construction of an extension, including heating apparatus, electric conduits and wiring, to the U. S. Post-Office at Crawfordsville.

EVANSVILLE, IND.—The Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. has purchased a terminal site and will erect a modern station in this city. Estimated cost, $150,000.

TERRE HAUTE IND.—The local lodge of Elks has ordered plans for a new lodge building. Bids will be in order the first of the year.

INDIANAPOLIS, IND.—J. S. FARRELL, of this city, has been awarded the contract for the plumbing for the new Deaf and Dumb Institute. Contract price, $74,657.

BLOOMINGTON, IND.—The Trustees of Indiana University have taken steps toward the erection of a chemical building and an addition to the library building.

INDIANAPOLIS, IND.—The [illegible] Public Works announces that pla[illegible] specifications for erection of the new [illegible] are ready for bidders. The str[illegible] estimated to cost $400,000 and [illegible] desire to complete it by June 15.

DETROIT, MICH.—Donalds[illegible] Meier, Archs., have prepared plans [illegible] building for the Y. M. C. A. Estima[illegible] $400,000.

ANN ARBOR, MICH.—Donal[illegible] & Meier, Archs., 1314 Penobscot Bldg[illegible]t, Mich., have been commissioned to pr[illegible] plans for a memorial hall for the Assoc[illegible] Alumni of the University of Michiga[illegible] Estimated cost, $150,000. Jas. H. W[illegible] 10 South State St., is Secy.

DECATUR, ILL.—The St [illegible] Roman Catholic Church will erect a [illegible] church here.

CARTHAGE, ILL.—Plan[illegible] specifications will be received by Ja[illegible] Westfall, Clk. Bd. of Supervs. of [illegible] County, until Jan. 15 for a court[illegible] for said county, the cost not to ex[illegible]25,000.

CHICAGO, ILL.—Pond & [illegible] Archs., 17 Van Buren St., are taking f[illegible] the superstructure of an office [illegible] to be erected at corner of Drexel [illegible] and 58th St., for the American School [illegible] Correspondence, 3321 Armour Ave. Th[illegible] is to be four stories, 96 × 130 f[illegible] of brick and stone. Cost, $75,000.

LA CROSSE, WIS.—Wel[illegible] Bennett, Arch., has plans for a cem[illegible] steel armory and auditorium for [illegible] M and Dana's Third Regiment Band [illegible] Wisconsin National Guard. Natatorium, [illegible] gallery, gymnasium, public shower [illegible] and seating capacity of 3,000 are so[illegible] of the features provided. Ground dimensions are 120 × 200 ft. Cost, $60,000.

MINNEAPOLIS, MINN.—Plymouth Congregational church has purchased a quarter block at Vine Place and 19th St. and will begin the erection in the spring of a modern church building to cost $150,000. The building will be of stone and concrete construction, 110 × 140 ft., with tower and belfry. Rev. L. H. Halock, 800 Nicollet Ave., is pastor.

MINNEAPOLIS, MINN.—Gordon, Tracy & Swartout, Archs., 244 Fifth Ave., New York, N. Y., are preparing plans for a 4-story club house, 95 × 137 ft., for the Minneapolis Club, W. C. Edger, Chn., 11[illegible] South Sixth St., Minneapolis. Cost, $2[illegible]. William C. Whitney, Minneapolis, is Associate Arch.

LINCOLN, NEB.—It is reported that a new engineering building will be erected at the University of Nebraska. Estimated cost, $100,000.

KANSAS CITY, MO.—Bids were opened Dec. 18, at the office of James Knox Taylor, Supervising Arch., Treasury, Washington, D. C., for interior repairs, painting, etc., at the Kansas City Post-Office building. Bids were as follows: Pioneer Linseed & Lead Co., Kansas City, $33,190, 250 days; Shackelford & Timmons Wall-Paper & Paint Co., Kansas City, $27,173, 140 days; Matthew Madden, Kansas City, $29,565, 120 days; R. T. Kinsella, Springfield, Ill., $21,857, 150 days; Winlers & Lorey, Kansas City, $29,079, 150 days; W. W. Gillespie, Topeka, $29,620, 120 days; P. I. Mooley, Kansas City, bid incomplete.

KANSAS CITY, MO.—Frederick G. Bonfils, of Denver, Colo., will erect a 20-story fireproof building, to cost between $500,000 and $600,000. It will be erected at Tenth and Chestnut Sts.

SAN ANTONIO, TEX.—George B. Berger, of Denver, Colo., has purchased a building site here and will erect an apartment house at a cost of $100,000.

OKLAHOMA CITY, OKLA.—Plans by C. Bulger, of Galveston and Dallas, Tex., have been adopted for proposed edifice for St. Luke's Methodist Church, 97 × 152 ft. Cost, $65,000 to $75,000.

WALLA WALLA, WASH.—McLEAN & McCALLAN have secured the contract for the construction of the Motter-Wheeler building, to be constructed in the immediate future at the corner of Third and Alder Sts. The bid was for $105,750. Noted on Dec. 13.

SEATTLE, WASH.—Donnellan & Houghton, Archs., 318-319 Denny Bldg., will prepare plans for the theater, store and office building to be erected at Third Ave. and Madison St., by John W. Cond[illegible]ne and Timothy Sullivan, both of New York.

Crawford, Conover & Fisken, 202-3 New York Block, are to erect an 8-story hotel, 120 × 180 ft., at Eighth Ave. and Madison St., at a cost of $400,000.

Crane & Co. have been granted a permit to erect a steel and reinforced concrete building at 419 Second Ave. South, to cost $175,000.

LOS ANGELES, CAL.—F. W. MAULE, Laughlin Bldg., City, has been awarded contract for a 6-story apartment house, to be erected on Olive St., near Third St., for Mrs. F. G. Cattern. Cost, $8[illegible]. Thornton Fitzhugh is Arch., Laughlin Bldg.

Contracts will be let at once for the construction of the Noble Building, which is to be erected at Adams and First Sts. John Noble, who owns the lot and will build, and A. W. Galpin, his local manager, are both in Los Angeles. Plans for the building were drawn by Harrison Albright, Arch., 1201 West 37th St., Los Angeles, and call for a building to cost $100,000.

SAN JOSE, CAL.—Plans and specifications are wanted for school buildings for which $400,000 of bonds were voted in October last. Alexander Sherriffs is Supt. of Schools.

SACRAMENTO, CAL.—R. A. Herold, Arch., Stoll Block, has prepared plans for proposed new city hall. Estimated cost, $200,000.

SAN FRANCISCO, CAL.—Mrs. Florence Blythe-Moore has filed with the Board of Public Works an application for a permit to erect a Class A building of reinforced concrete and [illegible] at Market and Second Sts. The building will be six stories in height and will cost $300,000. Bliss & Faville are the architects and MAHONEY BROS. the contractors.

The Italian National Bank has applied for a permit to erect a 3-story building of concrete, steel, and bricks on the corner of Montgomery and Sacramento Sts., at a cost of $120,000.

The Sharon Estate has asked for a permit to erect a [illegible]500 building on the south side of Howard St., near Third St.

S. L. Gold[illegible] has applied for a permit for the erection of a 7-story and basement brick building on the north side of O'Farrell St., between Mason and Taylor Sts., to cost $122,000.

Johann A. Schmidt will erect an 8-story Class A building at Kearney and Geary Sts. Steel frame and reinforced concrete. Cost, $175,000. Hermann Barth is Arch.

SAN FRANCISCO, CAL.—M. A. Gunst will erect a 10-story Class A building at Mission and Third Sts. Estimated cost, $125,000. Lansburgh & Joseph are the Archs.

A Class A building will be erected by Edward F. Delger, of Oakland, at Market and Sixth Sts. The cost probably will be $450,000. The building will be ten stories high, with reinforced concrete walls and floors and steel frame. Herman Bartha is Arch.

The Land Wharton Co. has applied for a permit to erect a 4-story reinforced concrete building, to be faced with brick, to be located on the southeast corner of Bush and Sansome Sts., to cost $70,000. Provision is made to add later several more stories.

J. Cotton Pelton, Arch., has prepared plans for a 6-story and basement building, Class A, to be erected at Second and Natoma Sts. Cost will be about $150,000. Barker, Knickerbocker & Bostwick are the owners.

Hermann Barth is Arch. for reinforced concrete warehouse to be built by M. J. Brandenstein & Co. at Spear and Mission Sts.

F. and A. Barnet will erect a 6-story office building on the southwest corner of Third and Stevenson Sts., at a cost of $80,000.

OTTAWA, ONT.—The contract for building the extension to the House of Commons of the Parliament buildings, has been awarded to McGILVERAY & LABELLE of Ottawa, for $235,000.

OTTAWA, ONT.—In the Federal estimates, for the coming year, for Ottawa are: $25,000 to complete the survey work and cost of a waterway from Montreal to Georgian Bay via Ottawa; $55,000 for the completion of the Royal Mint; $100,000 for improvements in Rideau Hall; $175,000 for additions and alterations to the Parliament Buildings; $200,000 for the Victoria Memorial Museum; $75,000 for an addition to the Eastern Departmental Block, and $400,000 towards the new departmental buildings facing Major's Hill Park, and the purchase of the necessary site; $24,000 for an addition to the Supreme Court library; $120,000 for rental of public buildings in the city; $175,000 for the Dominion public buildings generally in this city, including repairs; $40,000 for new fittings in the public buildings; $5,000 for the construction of a wharf at the foot of Rideau Canal, and $7,500 for the National Art Gallery, including the purchase of pictures, and $75,000 for the Royal Mint, authorized by statute.

WINNIPEG, MAN.—Rufus Pope, Montreal, Que., is arranging for the erection of a large modern apartment block on his property at Langside and Furby Sts.

WATER SUPPLY—IRRIGATION.

The names of parties awarded contracts are printed in capital letters.

BOSTON, MASS.—Bids are asked until Dec. 27 by William J. Welsh, Water Comr., for furnishing 1,455 tons of c. i. water pipe.

NEW YORK, N. Y.—Bids are asked until noon, Jan. 8, by the Aqueduct Commissioners for furnishing and erecting flashboard equipment on the spillway of the New Croton Dam. The dam is located in the Town of Cortlandt, Westchester County, New York, about 2½ miles from Croton-on-Hudson, on the New York Central and Hudson River Railroad, Hudson River Division, approximately 35 miles from New York. The length of the spillway is approximately 1,000 ft. The flashboard equipment consists of flashboards, c. i. bents, a narrow gage track, a car, concrete walk, galvanized iron railings, a concrete storage house and other minor accessories. The security required will be $6,000 and the work must be completed in 120 days. Harry W. Walker is Secy., John F. Cowan is Pres.

LOCKPORT, N. Y.—The City Council on Dec. 21 awarded the contracts for construction of the new water-works system complete, the total cost to be $486,598. The awards were as follows: For building pumping-station complete, including foundations, C. N. STAINTHORPE & CO., of Lockport, at $20,008. This company also has contract for furnishing three Holly engines, capacity of 5,000,000 gallons each, at $11,970; electric driving power for pumps at $19,525; stack and boilers for pumping station, at $28,000. Contract for intake crib, at $11,000; pipes from crib to pump well, $56,400; pump well, $12,400; total $79,800, was let to BUFFALO DREDGING CO., D. S. Morgan Bldg., Buffalo; and contract for 13 miles of steel pipe, T. A. GILLESPIE CO., 71 Broadway, New York, at $[illegible],000.

NEWARK, N. J.—The Water Committee of Board of Public Works has been asked to lay a water main through Ave. R. from Doremus Ave. to plant of Butterworth-Judson Co.

PORT COLDEN, N. J.—The Easton & Washington Traction Co. is planning to build a reservoir east of the power plant at Port Colden. It will be constructed for the use of the plant but will also be used as a skating pond in the winter. Waldo Sawen, Easton, Pa., is Ch. Engr.

BOUNDBROOK, N. J.—The Boundbrook Water Co. has applied to the Board of Street Commissioners of South Boundbrook for the right to lay their water mains through all of the streets of the borough.

WILLIAMSPORT, MD.—D. G. Adelsberger, Engr., Baltimore, Md., will submit to the Town Council a proposition to install water-works. It is proposed to erect a standpipe on the highest elevation above town and secure water from the Potomac River. It is estimated that a system can be established for $25,000 or $30,000.

CLARKSBURG, W. VA.—It is reported that Clarksburg Board of Trade, Charles E. Lamberd, Secy., is negotiating with a number of hydraulic engineers with a view to having them prepare surveys and a list of what will be needed to equip water plant suitable for a city of 50,000 people.

SANDERSVILLE, GA.—The citizens are reported to have voted Dec. 5 to issue $30,000 bonds for extending the water-works, and installing a sewerage system.

BUENA VISTA, GA.—Bids are asked by the city, for the best method of developing water supply. Well is 245 ft. deep. (Advertised, Engineering News.)

WYLAM, ALA.—It is reported that the Birmingham Water-Works Co. of Birmingham, Ala., has applied for franchise to lay water mains.

JONESBORO, ALA.—The Town is considering the installation of water-works.

ALGIERS (New Orleans post-office), LA.—THE CAROLINA CEMENT CO. is reported to have secured the contract to furnish all cement required in the new purification plant of the Sewerage and Water Board, at Carrollton and Algiers. About 110,000 bbls. will be required. H. Ball Bowers is Agt., at New Orleans.

MER ROUGE, LA.—The Town has awarded contract to the HART WELL CO. of Plaquemine, La., to sink a 6-in. artesian well to supply the town with water. It is also proposed to extend the water mains 5,500 ft.

LIMA, OHIO.—The City Council is reported to have passed an ordinance providing for an issue of $10,000 of bonds for the construction of a 24-in. iron conduit.

GIRARD, OHIO.—C. F. Brotherton, of Ashtabula, has a franchise to install a water-works system in Girard.

CLEVELAND HEIGHTS (Cleveland Post-office) OHIO.—Bids will be received until Jan. 15 by W. G. Phare, Village Clk., at his office, 204 Am. Trust Bldg., for improving Mayfield Road by laying 754 lin. ft. 6-in. c.-i. water pipe. Evers Eng. Co., Engrs., The Arcade.

GREENWOOD, IND.—The Greenwood Water & Light Co. announces that it will remodel and re-equip its plant in this city.

O'FALLON, ILL.—The BYRNE CONSTRUCTION CO., of St. Louis, Mo., has secured the contract for extending the water mains at 63½ cts. per ft. Total cost, $6,601. John Seddon is Mayor.

ATLANTIC, IOWA.—The Chicago, Rock Island & Pacific Ry. Co. is contemplating the building of a water pumping station at this town.

OELWEIN, IOWA.—The Chicago Great Western Ry. Co. is considering a plan to erect a water-works and ice plant, to cost about $45,000. W. H. Chadbourn, St. Paul, Minn., is Ch. Engr. C. G. W. Ry.

DES MOINES, IOWA.—We are officially advised that contract for constructing water system at the State Fair Grounds has been let by the Department of Agriculture to the DES MOINES BRIDGE & IRON CO., at $10,811. J. C. Simpson is Secy.

FRONTENAC, KAN.—Bids probably will be received about Jan. 1 for the construction of water-works, for which the citizens voted on Dec. 3 to issue $18,000 of bonds. H. J. Whiteleather is City Clk.

OMAHA, NEB.—The Water Board is reported to have adopted a resolution providing for the appointment of a committee to procure plans and estimates for construction of municipal water-works. If constructed it would cost about $4,000,000. A. Rosewater is City Engr.

PLATTSBURG, MO.—It is reported that contracts for water-works have been awarded as follows: To the MASSILLON IRON & STEEL CO., The Rookery, Chicago, Ill., c.-i. pipe, $37.60 per ton and specials 3 cts. per lb.; to LUDLOW VALVE MFG. CO., Adams St., Troy, N. Y., for hydrants, valves and valve boxes; to P. McGARRY & SON, 1175 St. Pauline St., Chicago, Ill., for standpipe; FAIRBANKS, MORSE & CO., Franklin and Monroe Sts., Chicago, Ill., for a 32-HP. gasoline engine; GOULD MFG. CO., triplex power pump. The stone, brick, cement, lime, sand and other material all purchased. George Cadogan is Engr., 808 Royal Insurance Bldg., Chicago, Ill. Bids were received Dec. 11.

EL PASO, TEX.—It is reported that the Mexican Government has ratified the treaty with the United States providing for the construction of the dam across Rio Grande River, above El Paso in New Mexico, and for an equal distribution of the waters of the river between the two countries for irrigation purposes.

SAYRE, OKLA.—Burns & McDonnell, Dwight Bldg., Kansas City, Mo., have been selected to prepare plans and specifications for water-works. Bids will not be received until early spring.

ALBUQUERQUE, N. MEX.—Bids are asked by Burton B. Custer, Supt. Indian School, Alburquerque, until Jan. 5, for furnishing and delivering to the school as required during the fiscal year, ending June 30, 1907, about 38 tons c.-i. water pipe, 8 first hydrants and tees, crosses, ells, valves, etc.; one triplex pump, direct connected to 10-HP. motor; one horizontal centrifugal pump, belted to 5-HP. moter; also a quantity of brick, lumber, etc.

LAS CRUCES, N. MEX.—The Secretary of the Interior has awarded a contract to the MIDLAND BRIDGE CO., 622 Gibraltar Bldg., Kansas City, Mo., for furnishing steel and c.-i. for the Rio Grande irrigation project, N. Mex. The contract calls for about 55,000 lbs. of steel bars for reinforcement of concrete, about 12,800 lbs. of structural steel and about 9,000 lbs. c.-i. gates, guides, stands, etc.

COALGATE, IND. T.—Bids are asked until Jan. 9, by the City of Coalgate for supplying c.-i. pipe, and specials, boilers, pumps, hydrants and valves for water-works construction. The O'Neil Engineering Co., Dallas, Tex., is Engr. (Advertised, Engineering News.)

PUEBLO, COLO.—The Badito Reservoir, Irrigation & Land Co. is reported incorporated by P. J. Lesser, Joseph Blair and I. N. Blair and others, to build reservoirs for the purpose of irrigating lands in Huerfano, Pueblo, Otero and Las Animas Counties; capital, $8,000,000. The water is to be taken from the watershed of Huerfano River in the western part of Huerfano County. Besides irrigation, water will be used for power and manufacturing purposes in mines and mills. The offices and the principal place of business will be in Denver.

HILLYARD, WASH.—The water system at Hillyard is to be enlarged at a cost of between $20,000 and $30,000.

SEATTLE, WASH.—According to estimates prepared by R. H. Thomson, City Engr., the total expenditure of the new water-works extension will aggregate between $2,225,000 and $2,500,000. The contemplated improvements will call for a new 54-in. pressure pipe from the headworks of the water system at Cedar River to the city and also three new and very large reservoirs. One of the latter will be located in the south portion of Beacon Hill and will have a capacity of 100,000,000 gallons of water, while the other two, with a capacity of 50,000,000 gallons each, will be situated north of Green Lake. In addition to the above, three large "booster" pipes, extending from the vicinity of the reservoirs to the western part of the city towards the water front will be installed. With the addition of the above to the municipal water system the supply and pressure along the water front will be greatly reinforced. One of the pipes will cut into the old system along Union St., from Eighth Ave. to Western, the second will cut in near South Seattle St., and the third at Ross Station, near the Government canal.

SAN DIMAS, CAL.—The San Jose Mutual Irrigation Co. is reported to have been incorporated by G. W. Griffith, Jr., of Covina; Elmer E. Hart and C. H. Cannon, both of San Dimas, and others, to develop a water supply from the storm waters of San Dimas Canyon and its tributaries. A dam 104 ft. high of steel and concrete will be built.

DANVILLE, QUE.—The franchise to put in a system of water-works has been given to Henri Girard. The work will begin in the spring of 1907.

CHATHAM, ONT.—The citizens will vote at the next municipal election on a by-law to install an entirely new water-works pumping station and electric light station.

PEMBROKE, ONT.—Bids are asked until Jan. 5 for supply of steel pipe for intake, well lining and connections with pumps, and all specials and valves, being all steel and iron work. The 18-in. intake will be 7,000 ft. long, and the well will be 7½ ft. in diameter. James P. Sarsfield, Chn. Water-Works, Pembroke; J. L. Morris, Pembroke, is Engr.

WINNIPEG, MAN.—An additional electric generator for the pumping plant will be purchased to generate 1,000 HP. Estimated cost, $80,000. F. E. Cambridge is City Electrician.

ARCOLA, SASK.—Bids are asked by J. S. Bush, Secy., until Jan. 2, for an elevated steel water tank having a capacity of 60,000 imperial gallons erected on a steel superstructure 40 ft. high; an elevated wood water tank having a capacity of 60,000 gallons, erected on a steel superstructure 40 ft. high.

SEWERAGE.

The names of parties awarded contracts are printed in capital letters.

ROCHESTER, N. Y.—J. Y. McClintock, County Engr., Rochester, has submitted his report on the disposal of sewage of Greece, Irondequoit, Webster and other towns, in which he favors regulating the flow of Genesee River, and so disposing of the sewage.

NEW YORK, N. Y.—The following bids were received by Louis F. Haffen, Pres. Boro. of The Bronx, on Dec. 18, for constructing an outlet sewer and appurtenances in Ave. E, between East 152d and Westchester Ave.: S. M. Pasquate, Williamsbridge, N. Y., $521,825; F. V. Smith Contracting Co., 147 East 125th St., $402,411; Burns & Rodgers, 1929 Amsterdam Ave., $456,694; J. J. Hart Co., 173d St. and Broadway, $388,497; Briggs & McLaughlin, 19 East 130th St., $406,874; C. G. Vermilye, 84 St. Nicholas Pl., $484,505; Atlanta Cont. Co., 432 East 91st St., $600,763; W. F. Murray, 1155 Boston Road, $636,120; T. A. Haggerty, $510,845.

BINGHAMTON, N. Y.—Plans for the $85,000 trunk sewer are before the State Board of Health for approval, and as soon as they are returned to this city contractors will be asked to submit bids for the work.

BUFFALO, N. Y.—The lowest bid opened on Dec. 13 for constructing 18, 15 and 12-in. tile sewers on the southwest side of Humboldt Parkway and Agassiz Pl., is stated to have been submitted by W. G. Smith for $8,990. Francis G. Ward is Comr. Pub. Wks.

ITHACA, N. Y.—We are informed that the sewer commission is about to prepare plans for a septic tank in connection with the sewage disposal plant, and information regarding such plants is wanted. W. O. Kerr is Secy.

NORRISTOWN, PA.—Bids will be asked soon for a double 8-in. sanitary sewer, with flush tanks, about 1,200, on De Kalb St. and an 8-in. sanitary sewer on Beach St., 800 ft. long. S. Cameron Corson is City Engr.

WYTHEVILLE, VA.—The Wytheville Sanitary Co. will construct sewerage system. A. F. Brown, Culpepper, Va., is Engr.-in-Charge.

CHARLESTON, W. VA.—The Drainage Committee of the City Council and a special committee from the Chamber of Commerce at a meeting recently held decided to recommend that $200,000 be expended for the construction of sewerage system, for which $125,000 of bonds were voted; the remaining $75,000 to be paid by property owners along line of sewerage. T. Chalkley Hatton of Wilmington, Del., who prepared the plans for the system, will probably be commissioned to superintend the construction.

GREENVILLE, S. C.—The Burt Caisson Construction Co., of Gloversville, N. Y., is reported to have secured the contract for constructing sewers at Greenville, N. C., for about $13,410. Bids were received Dec. 6.

ORANGEBURG, S. C.—Bids are asked until noon, Jan. 23, by the Board of Sewerage Commissioners for constructing a system of sewers for this city. Edward Hawes, Jr., is City Engr.; Thomas C. Doyle is Chn. (Advertised Eng. News).

COLUMBUS, GA.—Bids are asked until Dec. 28 by M. M. Moore, Clk. of Council, for furnishing supplies and doing the following work during the year 1907 from Jan. 1: Furnishing terra-cotta drain and sewer pipes, to be delivered where directed, and including 4, 5, 6, 8, 12, 15, 18 and 24-in.; also the following size terra cotta running traps, 4, 5, 6, 8 and 10-in., made with hand holes, and 12-in. traps without hand holes; brick for sewer or other purposes; grates or other castings for sewer or other purposes; lumber to be delivered as directed. Bids on lengths over 32 ft. may be specified separately. W. C. Campbell is Supt. Pub. Wks.

ST. AUGUSTINE, FLA.—City will vote Jan. 8 on the issuance of $100,000 of bonds for constructing sewer system. E. E. Boyce is Mayor.

LAKE CHARLES, LA.—J. A. Landry and associates are reported to have submitted to Council a proposition to install a $100,000 sewerage system.

TOLEDO, OHIO.—Bids probably will be received about Apr. 1 for a relief sewer to be about a quarter of a mile in length, from 24 to 72 in. in diameter, of brick and concrete, to cost about $40,000. F. I. Consaul is Ch. Engr., Bd. of Pub. Service.

CINCINNATI, OHIO.—The William Haffron Construction Co., 811 Reade Bldg., was the lowest bidder, at $22,625, for constructing sewers in Observatory, Mooney and Menlo Aves., for which bids were received Dec. 19 by the Board Public Service. M. J. Keefe is Clk.; C. N. Dannenhower is Secy.

BLOOMINGTON, ILL.—William Sprague has secured the contract for pipe sewers from 12 to 30 in. in diameter in Front, Lowe and other streets at $4,929. Bids were received Dec. 14. Elmer Folsom is City Engr.

CAIRO, ILL.—This city contemplates constructing vitrified tile sewers of various sizes in sundry streets. Estimated cost, $58,275. George Parsons is Pres. Board of Local Improvts.; W. B. Thistlewood is City Engr.

CHAMPAIGN, ILL.—Bids were asked by the Commissioners of Camp Creek Special Drainage District, at office of Ray & Dobbins, Attys., until 9 a. m., Dec. 29, for the excavation of a dredge ditch, the whole work requiring 106.318 cu. yds. William D. Earl is Comr.

FOND DU LAC, WIS.—Bids probably will be called for after Feb. 1 for the construction of 12 miles of sewers. L. A. Pettibone is City Engr.

CEDAR FALLS, IA.—Bids are asked until Jan. 22 by the Sewer Commission for constructing storm water sewers, approximately 3,768 ft. in length and varying from 12 to 36-in. vitrified sewer pipe, and from 42 to 60-in. two-ring brick sewer.

BURLINGTON, IOWA.—Bids are asked until 4 p. m., March 18, at the office of the City Clerk for construction of vitrified pipe sewer and branches. J. F. Winters is City Engr. (Advertised, Engineering News.)

CLARINDA, IOWA.—This city contemplates constructing two lines of 6-in. sewer, 5,000 ft. each. C. W. Stuart is City Clk.; A. S. VanSandt is City Engr.

HALLOCK, MINN.—We are advised that JAMES KENNEDY, Fargo, N. Dak., has contract, at $8,900, for constructing sewers in Hallock. J. E. Carroll, Crookston, Minn., is Des. Engr.; N. G. Brown is Village Clk.

HUTCHINSON, KAN.—This city contemplates constructing two miles of vitrified pipe sewer in the spring. S. J. Johnson is City Clk.

MINDEN, NEB.—We are officially advised that Burns & McDonnell, Dwight Bldg., Kansas City, Mo., have been selected to prepare plans and specifications for a sewer system. Bids will not be received until early spring.

BERESFORD, S. DAK.—Bids are asked by the City Council until 8 p. m., Jan. 7, for construction of about 700 ft. of 8-in. and 580 ft. of 6-in. sewer. H. A. Sturgess, is City Audr.

WEBB CITY, MO.—Bids are asked by W. E. Smith, City Engr., until Jan. 7, for furnishing material and constructing a sewer in District 16, to consist of 1,999 ft. of 8-in. sewer pipe, 170 Y junctions, six manholes, one flush-tank, etc.

KIRKWOOD (St. Louis post-office), MO.—The Board of Aldermen on Dec. 17 awarded the contract for installation of a sewer system in the Third District of Kirkwood to JOHN F. McMAHON, whose bid was $18,743. The work will probably begin immediately after the first of the year.

ARGENTA, ARK.—The city has passed an ordinance appropriating $75,000 for installing a complete sewerage system.

LITTLE ROCK, ARK.—Bids are asked until Dec. 31 for constructing sewer mains and laterals for Sewer District No 43. Henry Weidemann, Secy. Sewer District No. 46; Frank Wittenberg, Secy. Offices are at 204 Louisiana St.

VAN BUREN, ARK.—Bids are asked until noon, Jan. 22, by L. H. Southmayd, Comr. Sewer Dist. No. 1, for constructing 17,600 ft. of clay pipe sewers. Theo. Hartman, 1122 Center St., Little Rock, Ark., is Engr.-in-Charge. (Advertised, Engineering News.)

DENVER, COL.—The City Council has decided to construct a sanitary sewer in District No. 4. George E. Randolph is Pres. Bd. Pub. Wks.

PUEBLO, COLO.—A. E. McIntosh, City Engr., is preparing plans and estimates for a lateral to the storm sewer in Santa Fe Ave. CAHILL & RYAN were awarded contract to construct 8-in. pipe sewers at 72 cts. per lin. ft., manholes $43, and flush tanks $90. The STANDARD CONSTRUCTION CO. bid $1.15 per ft. for 8-in. pipe, $40 for manholes and $90 for flush tanks.

LOS ANGELES, CAL.—The contract for constructing a vitrified pipe sewer in East First St., from Main to Alameda Sts., was awarded by the Board of Public Works on Dec. 10 to A. P. PUSICH at $3,644.

TORONTO, ONT.—The ratepayers will vote Jan. 3 on a by-law to raise $3,000,000 for installing main intercepting sewers. C. H. Rust is City Engr.

RENFREW, ONT.—A by-law is to be submitted to the ratepayers of the town at the municipal elections in January to raise $6,000 for sewer extensions. It is to be made compulsory to connect all houses with the water-works and sewer systems.

STREETS AND ROADS.

The names of parties awarded contracts are printed in capital letters.

NEW YORK, N. Y.—Bids are asked until 11 a. m., Jan. 9, by Bird S. Coler, Pres. Boro. Brooklyn, for regulating, grading and paving various streets in Boro. of Brooklyn.

WATERVLIET, N. Y.—The TROY & GREEN ISLAND STONE CO. has been awarded the contract for paving 6th Ave.

Contract for vitrified brick paving has been let to E. KELLY & CO., Green Island, N. Y., the contract at $13,000. W. G. Staley is Secy Pub. Improvt. Comn.

TROY, N. Y.—The contract for paving with brick a portion of Pawling Ave. is reported to have been awarded to JOHN H. GLEASON at $23,743. Edward B. Cary is City Engr.

SYRACUSE, N. Y.—It is reported that the Common Council has declared intention of grading Dwight St., from Elsnore to Manlius Sts. F. J. Schnauber is City Engr.

BINGHAMTON, N. Y.—The Supervisors of Broome County will construct twelve miles of macadam road the coming year at a total expenditure of $120,000. The County probably will purchase the stone and do its own work. A. W. T. Back is interested. S. M. Baird is City Engr.

NIAGARA FALLS, N. Y.—We are officially advised that the WARREN BROTHERS CO., 93 Federal St., Boston, Mass., will lay 21,200 sq. yds. of bitulithic pavement.

SCRANTON, PA.—We are officially advised an additional contract for 2,518 sq. yds. of bitulithic pavement has been awarded the STANDARD BITULITHIC CO.

ALLEGHENY, PA.—The Board of Public Works will soon be ready to ask for bids for grading, paving and curbing Hubbard St., from Hening to McClure Aves.; also for grading and paving Pike Alley, from Unity Alley to Wooster St. D. D. Cadugan is Ch. Clk.; Charles W. Ahlers is Engr.

NEWPORT NEWS, VA.—City will vote Feb. 28 on the issuance of $100,000 of bonds for permanent street improvements. T. E. Pearse is City Engr.

ASHEVILLE, N. C.—We have been officially informed that the ATLANTIC BITULITHIC CO. has been awarded a contract for 6,500 sq. yds. of bitulithic pavement. B. M. Lee is City Engr.

SPARTANBURG, S. C.—A contract for 10,886 sq. yds. of bitulithic pavement has been awarded the ATLANTIC BITULITHIC CO.

ANDERSON, S. C.—The City will expend $75,000 during the coming year for cement sidewalks.

MOBILE, ALA.—The SOUTHERN BITULITHI CCO., of Birmingham, Ala., has secured a contract for 5,307 sq. yds. of bitulithic pavement, in addition to that recently announced.

MONTGOMERY, ALA.—The MEMPHIS ASPHALT & PAVING CO. has contract at $11,408 to pave Caroline and Wilson Sts.; the SOUTHERN BITULITHIC CO., of Birmingham, Ala., has contract to pave Montgomery St., at $17,765. Allen R. Gilchrist is City Engr.

NEW ORLEANS, LA.—Bids are asked until Dec. 31 by Charles R. Kennedy, Comptroller, for subsurface drains, culverts, curbs and gutter bottoms and sidewalk pavement on portions of St. Roch Ave. and Orleans St.; repaving with small granite block on a portion of Orleans St. and constructing artificial stone footwalks on a portion of Annunciation Sq.

KNOXVILLE, TENN.—It is reported that the American Suburban Corporation has awarded to JOSEPH ARMSTRONG the contract for laying about one mile of concrete sidewalks at Piedmont Pl., a suburb of this city.

CINCINNATI, OHIO.—Bids are asked until noon, Jan. 16, by the Board of Public Service for paving 4,730 sq. yds. of Highland Ave. with granite blocks at an estimated cost of $25,226. Bids are asked at the same time for paving 1,910 sq. yds. of Trade St. with brick, to cost about $8,136.

All bids for paving Colerain Ave. with granite have been rejected by the Board of Public Service. The work will be readvertised shortly.

The lowest bid received Dec. 19 by the Board of Public Service for paving Stanley Ave. was that of Augustus J. Henkell, 703 Mercantile Library Bldg., at $27,994. C. N. Dannenhower is Ch. Engr., Bd. Pub. Service; M. J. Keefe is Clk.

CLEVELAND HEIGHTS (Cleveland Postoffice), OHIO.—Bids are asked until Jan. 15 by William G. Phare, Village Clk., 204 American Trust Bldg., Cleveland, for furnishing material, grading, draining, macadamizing and constructing sidewalks on Stratford Road, from Fairmount Boulevard to Fairfax Road. F. A. Peace is Engr., 931 Williamson Bldg., Cleveland.

LONDON, OHIO.—The Board of Public Affairs contemplates constructing eleven miles of concrete sidewalks, 4 to 18 ft. wide. John Byers is Clk.; H. L. McCafferty is Engr.

TROY, OHIO.—Bids are asked until noon, Jan. 8, by the Board of Public Service, for paving the public square and two streets, in all about 35,000 sq. yds. L. A. Ziegenfelder is Clk.

YOUNGSTOWN, OHIO.—About $13,000 will be expended for repaving the McGuffey viaduct. F. M. Lillie is City Egnr.

STEUBENVILLE, OHIO.—Bids are asked until noon, Jan. 4, by the Board of Public Service, for paving Washington St., from Water to Third St. T. W. Vance is Clk.

INDIANAPOLIS, IND.—We are officially advised that the HOOSIER CONSTRUCTION CO. has been awarded a contract for 6,000 sq. yds. of bitulithic pavement.

TERRE HAUTE, IND.—DON M. ROBERTS has secured contract, at $29,890, for grading. The other bidders were: Meredith Construction Co., $31,990; W. C. Dorsey, $30,350; Foulkes & Forbes Co., $32,775; W. H. Harris, $30,400. Edgar Schmidt, is City Engr.

EAST ST. LOUIS, ILL.—Bids are asked until noon, Dec. 29, by the Board of Local Improvements for improving 13th St., from the northerly line of St. Clair Ave. to the southerly line of Nectar Ave. by sewering, filling, grading curbing and paving with brick the entire distance and between the points named. E. H. Eggmann is Clk. of Bd.; W. J. Crocken, is City Eng.

MARINETTE, WIS.—It is reported that plans are being prepared for paving portions of several streets, at a cost of $50,000.

KENOSHA, WIS.—Bids will be received in the spring for street paving, to cost $20,000.

LA CROSSE, WIS.—The special Street Improvement Committee has recommended to the Common Council that three miles of new paved streets be laid next spring. Contracts will be let in February for paving as follows: Brick paving on Cass St., from Third to Fifth Sts.; granite top dressing macadam on Sixth St., from Main to Vine Sts., on Eighth St., from Main to La Crosse Sts.; on Ninth St., from State to La Crosse Sts.; on Market St., from Seventh to 16th Sts; brick on Sixth St., from Cass to Jackson Sts.; creosote block on Cass St., from Fifth to Twelfth Sts. W. S. Woods is City Engr.

DULUTH, MINN.—The Board of Public Works on Dec. 7 opened bids as follows for grading, macadamizing and constructing sewers in a portion of 24th St: P. McDONNELL, $24,579 (awarded contract); Hugh Steele, $25,864, and George R. King, $30,697. Thomas F. McGilvray is City Engr.

TOPEKA, KAN.—The Board of County Commissioners is stated to have awarded the contract for macadamizing East Eighth Ave. Road to J. H. MAXWELL, at $1.46 per cu. yd. James F. McCabe is City Engr.

HELENA, MONT.—The following bids were received Dec. 10 by County Comrs. for constructing boulevard around base of Mount Helena to Broadwater, (a) solid rock, (b) loose rock, (c) earth (price given per cu. yd.): Adami Bros. & Lind, (a) 95 cts., (b) 50 cts., (c) 30 cts.; Louis Johnson, (a) $1, (b) 39 cts., (c) 24 cts.; McGowan & Ferarri, (a) $1.10, (b) 65 cts., (c) 17 cts.; Coty Bros., (a) $1.10, (b) 50 cts., (c) 18 cts. Total estimated cost of proposed improvement, $8,000. C. W. Heinlick is City Engr.

ST. LOUIS, MO.—We are officially advised that the GRANITE BITUMINOUS PAVING CO., Equitable Bldg., St. Louis, secured an additional contract for 42,429 sq. yds. of bitulithic pavement.

GALVESTON, TEX.—Bids are asked until Dec. 31 by the Board of County Commissioners for improving the Galveston County Sea Wall Boulevard, requiring about 23,180 sq. yds. vitrified brick pavement, 9,985 sq. yds. concrete sidewalk, 9,084 lin. ft. curbing, and 5,293 lin. ft. iron posts and railing. Bids may be submitted on the above as a whole or in sections. Valery E. Austin is Comr. Sts. and Pub. Property; C. C. Wells is City Engr.

DALLAS, TEX.—The TEXAS BITULITHIC CO. has been awarded contract for 23,694 sq. yds. of bitulithic pavement. E. L. Dalton is City Engr.

SEATTLE, WASH.—Ordinances providing for improvements of streets have been passed by the City Council. They are as follows: East Cherry St., concrete walks; 22d Ave., concrete walks; Weller St., concrete walks; East Spruce St., concrete walks; East Fir St., concrete walks; Wellington Ave., grading; 32d Ave., grading; Wallingford Ave., grading. Estimated cost, $104,620. R. H. Thomson is City Engr.

SPOKANE, WASH.—The contract for grading a portion of Ide Ave. is reported to have been awarded to MITCHELL BROS. at $7,000

PORTLAND, ORE.—It has been announced that all streets in the district from East 7th to East 14th and from Knott to Thompson Sts. in the Irvington District, making over three miles altogether, will be improved next spring with a hard surface pavement. Douglas W. Taylor is City Engr.

LOS ANGELES, CAL.—Petitions which were presented to the City Council a few weeks ago for the widening of Los Angeles St., from 7th to 23d Sts., to an 80-ft. thoroughfare and for paving the street with asphalt have been approved by the City Council and the Board of Public Works. The entire frontage from 7th to 23d Sts. is 6,885 ft. The property owners signing the petition represent 5,901 ft., which is about 85% of the entire frontage. Homer Hamlin is City Engr.

TORONTO, ONT.—Plans, specifications and bidding sheets for proposed asphalt plant, as advertised, are on file at the office of Engineering News, New York. Bids are asked until Jan. 8. C. H. Rust is City Engr.

TORONTO, ONT.—We are officially informed that contract for 11,711 sq. yds. of bitulithic pavement has been awarded to the WARREN BITUMINOUS PAVING CO.

EDMONTON, ALTA.—The ratepayers have passed a by-law to expend $121,000 for paving some of the principal streets.

A contract for 55,000 sq. yds. of bitulithic pavement has been awarded the WARREN BITUMINOUS PAVING CO., of Toronto, Ont.

MANUFACTURING PLANTS.

The names of parties awarded contracts are printed in capital letters.

BRIDGEPORT, CONN.—H. A. Howe, Jr., Arch., is revising the plans for the new factory building to be erected at the plant of the Harvey Hubbell Co. in the West End. It has been decided to build of reinforced concrete and to carry the building up five stories. The structure will be 52 × 114 ft., with an elevator.

UTICA, N. Y.—Mill No. 5 of the Utica Knitting Co., at Sherbourne Quarter, is soon to be enlarged. The floor space will be about doubled, the south end being extended about 60 ft. and the rear will also receive an addition. The wall front will be torn down and the building extended 25 ft. towards the street. The foundations will be of brick to match the present building. The present number of about 100 hands will be nearly doubled. E. S. Sweet is Mgr.

ALBANY, N. Y.—In the issue of Dec. 13 it was stated that Arthur Peck Loth was architect for a shirt factory to be erected on Perry St. for Hall, Hartwell & Co. This is an error, as the architect is Edward W. Loth, 253 Broadway, Troy, N. Y.

DOVER, N. J.—The War Department, Washington, D. C., has decided upon a site in Dover, on which it is proposed erecting the powder factory for which Congress has appropriated $165,000. The approximate capacity of the power plant to be installed is 200 HP. Most of the buildings will be erected by the War Department without contract; contracts for the few which are to be erected in that manner will probably be let about the beginning of the year. No architect or designing engineer is employed in connection with the work. Brig. Gen. William Crozier is Ch. of Ordnance, U. S. A., War Dept., Washington, D. C.

DONORA, PA.—The stockholders of the Donora Brewing Co., it is stated, have decided to double the capacity of the plant.

ALLENTOWN, PA.—The Allentown Portland Cement Co., Allentown National Bank Bldg., will let contract about Mar. 1 for the erection of a cement plant to cost about $800,000. There will be a stone crusher and drying building, 146 × 66 ft.; mill building, 162 × 130 ft.; kiln building, 162 × 178 ft.; an L, 33 × 50 ft.; power house, 114 × 130 ft.; coal storage, 97 × 34 ft.; stock house, 100 × 416 ft.; machine shop and supply house, 60 × 150 ft., and office and laboratory, 40 × 60 ft. The power plant will cost about $200,000.

PHILADELPHIA, PA.—Ballinger & Perrot, Archs. and Engrs., 1200 Chestnut St., have awarded contract to PHILIP HAIBACH, 26th and Thompson Sts., for alterations to offices and addition to shipping department of the Fern Rock Woolen Mills, Trenton Ave. and Wishart St. The addition to the shipping department will be of brick and timber construction, 25 × 25 ft., one story. Work will be commenced at once.

Ballinger & Perrot have completed drawings and specifications for a warehouse and factory to be erected on the west side of 30th St., near Locust St., for the Hires-Turner Glass Co., 626 Arch St. The building will be 131 ft. on 30th St. and extend to a depth of 275 ft. It will have two stories and basement. Walls to be of Avondale stone, with bluestone trimmings. Columns, floors and roof construction will be of slow-burning wood construction. Windows on exposed fronts will be protected with wire glass in metal frames.

STANTON, DEL.—The proposed new plant to be erected by the Delaware Hard Fibre Co., of Wilmington, Del., at Stanton, will cost about $100,000. There will be no contract let for buildings, but there will be a contract for power plant, which will consist of 300-HP. boilers and a 150-KW direct generator will be let about Mar. 1.

BALTIMORE, MD.—The Co-operative Plate Ice Co., recently incorporated, with $200,000 capital, has purchased site 111 × 165 ft. at 7 South Frederick St. and will erect 2-story reinforced concrete ice plant. The cost of building and equipment will be about $175,000; capacity will be about 150 tons per day, with storage facilities for 12,000 tons. Officers of company are: Grant Stockham, Pres., 706 American Bldg.; Robert Newcomer, Vice-Pres. and Gen. Mgr., 119 North Fulton Ave.; Charles A. Browne, Calvert Bldg., is Mgr. of Construction, and Douglas O'Brien, Philadelphia, Pa., Consult. Engr. Contracts for tanks have been awarded.

The News Publishing Co., proprietors of the Baltimore News, Calvert and Fayette Sts., will erect an addition to its plant; six stories, 30 × 75 ft.; Indiana limestone exterior; reinforced concrete construction; additional presses will be installed. Baldwin & Pennington are Archs., Professional Bldg., 330 North Charles St.; JOHN WATERS is Builder, 23 East Center St., and BALTIMORE FERRO-CONCERE [illegible] Glenn Bldg., St. Paul St., near Fayette St., contractor for reinforced concrete work.

WASHINGTON, D. C.—Columbia Brick Co., Inc., 525 13th St., N. W., recently incorporated, has organized with following officers: O. B. Blackburn, Pres.; C. E. Wood, Vice-Pres.; C. M. [illegible], Treas., and L. V. Snook, Secy. The plant will have capacity of 80,000 bricks a day and 2-story building 75 × 200 ft. will be erected. The company wants prices on considerable machinery and supplies. John [illegible] Schaffer, 525 13th St. N. W., Engr.-in-Charge.

BROADFORD, VA.—Southern Gypsum Co., incorporated in July, will mine gypsum and manufacture gypsum products; daily capacity 400 tons. A frame building will be erected. F. A. Wilder is Pres.; [illegible] A. Ristine, Vice-Pres.; Chas. Hull Ewing, Secy.-Treas., and C. H. Wallinger, Supt.

PULASKI, VA.—Hygienic Ice & Cold Storage Co. has been organized with $15,000 capital stock to operate 10-ton ice and cold-storage plant. A building, [illegible] 100 ft., will be erected. About $12,000 will be expended in building and equipment. George D. Peters is Pres.; J. A. Van [illegible], Vice-Pres., and J. M. Bosonk, Secy.-Treas.

NEWPORT NEWS, VA.—The Old Dominion Land Co. has let contract to E. MORGAN for the erection of building to be occupied by the Monarch Steam Laundry. The building will have two stories, 25 × 100 ft. and be constructed of brick. Cost, $5,000.

PARKERSBURG, W. VA.—A company is being organized by W. W. Watterson, Junius R. H. Radeker and associates with $25,000 capital to establish a plant to manufacture all sorts of frames for houses, stairs, porch columns, window sashes, etc. A 3-story brick building has been secured and machinery will be installed at once. Sufficient ground has also been purchased for lumber yards.

CANA, N. C.—Cranfill Bros., R. F. D., No. 1, will rebuild plant recently burned. It is proposed to erect a 3-story building, 20 × 40 ft. for roller mill, also sheds for sawmill; capacity 6,000 to 10,000 ft. About $3,000 will be invested.

HIGH POINT, N. C.—The New Century Wire, Steel & Iron Works with factories at Wichita, Kans., Harvard, Neb., Boonville, Mo., McMinnville, Oregon and Talure, Cal., contemplates establishing a plant here.

FAYETTEVILLE, N. C.—Fayetteville Ice & Manufacturing Co. has purchased site on which to erect 60-ton ice plant.

SELMA, N. C.—Selma Knitting Mills, it is reported, will add 40 knitting machines and new machinery in dyeing and finishing department. M. C. Winston is Pres.

CHARLESTON, S. C.—The plant of the Royal Bag & Yarn Manufacturing Co. will soon be increased 25%, the machinery necessary for the increase in the output having already been ordered. The new equipment pbobably will be in place by the middle of January. The plant at present has a capacity of about 200,000 lbs. of cotton a month. A new building for the bag manufacturing machinery has recently been constructed, and all of the machinery in the old building has been transferred to it. George A. Wagener is Pres.

CALHOUN, GA.—J. M. Lang and associates contemplate establishing plant for the manufacture of pulp or paper from the refuse of sawmills at Calhoun.

ATLANTA, GA.—The Central of Georgia Ry. Co. is erecting near Fort McPherson, freight and construction yards, which will cover 400 acres and will cost over $500,000. The officials of the road in having the yards laid, will cause suitable sites for factories and plants to be prepared. The yards now in course of construction will be the largest in the vicinity of Atlanta. C. K. Lawrence is Ch. Engr., Savannah.

OXFORD (Anniston post-office), ALA.—R. W. Fisher contemplates establishing brick plant at Hobson City.

JACKSONVILLE, ALA.—Ide Cotton Mills' stockholders will hold a meeting on Jan. 14 to increase capital stock from $200,000 to $750,000 and plan the erection of an additional mill of 25,000 spindles and a new power plant. Both present plant and new mill will be driven by electricity.

DECATUR, ALA.—Standard Lumber Co., incorporated Dec. 6, with $15,000 capital, will operate a sawmill with a daily capacity of 20,000 ft. A building 40 × 90 ft. will be erected. J. B. Boucher is Pres.

ELLISVILLE, MISS.—Lowery Lumber Co. will erect three 80-ft. dry kilns, replacing structures reported burned Dec. 13. Between $7,000 and $8,000 will be expended.

LAKE CHARLES, LA.—The Armour Packing Co. will erect a new cold storage plant in this city.

MONROE, LA.—L. L. Lieber, who has purchased and will operate the plant of the Southern Lumber Co., will erect creosoting plant in the spring to be operated in connection and will want equipment.

ALGIERS (New Orleans post-office), LA.—Bates-McAvoy Box Co. and the Murphy Lumber Co. have been consolidated, and the Louisiana Export, Box & Lumber Co. has been chartered to operate the combined plant. Capital, $200,000. It is proposed to arrange at once for the erection in Algiers of box factory 100 × 200 ft. and a private wharf 225 × 400 ft. About $100,000 will be expended. The daily capacity is to be about five carloads. W. M. Murphy is Pres.; C. D. McAvoy, Vice-Pres., and E. E. Johnson, Secy.-Treas.

LOUISVILLE, KY.—The Pickrell Cart & Wagon Works has been incorporated with $30,000 capital to manufacture wagons and carts. Daily capacity, three. A 3-story brick and frame building will be erected and about $15,000 invested in building and equipment. Otis W. Pickrell is Pres.; Geo. E. Terrell, Vice-Pres.; John Pickrell, 602-614 Brook St., Engr.-in-Charge. The offices are at 43 U. S. Trust Bldg.

CINCINNATI, OHIO.—The Triumph Mfg. Co. will erect a modern plant to manufacture baking machinery on Spring Grove Ave. on a lot 144 ft. front in the avenue, running to a depth of 275 ft. in Sassafras St.

INDIANAPOLIS, IND.—Bids have been received for the boiler and forge shop of the Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. at Indianapolis, and the contract will be let shortly. Work on the power-house, tank shop and the storehouse is being pushed rapidly.

BATTLE CREEK, MICH.—The Arnold Co., 181 La Salle St., Chicago, Ill., engineers and contractors, informs us that the new locomotive shop of the Grand Trunk Ry. System at Battle Creek, Mich., will include the machine and erecting, boiler and tank shops under one roof. The building will be 170 × 817 ft., with 25 erecting pits, 9 boiler stalls and 9 tank stalls. The foundation work has been started. Other buildings of the locomotive department will follow shortly, as the intention is to complete the buildings of this department for operation before the end of 1907. E. D. Jameson is Master Mechanic, Battle Creek.

ALPENA, MICH.—The Huron Cement Co. will build a 3,000-barrel plant at Alpena. The company is capitalized at $1,200,000, with J. B. and E. L. Ford, of Detroit, as the largest stockholders. The Avery mill site and large water frontage has been purchased. The erection of the plant will begin in early spring. Some preliminary work has been done.

PONTIAC, MICH.—The Pontiac Garment Co. has been incorporated with $30,000 capital. A new factory will be erected for manufacture of women's apparel. W. L. Brazie, of Detroit, is Mgr.

GRAND RAPIDS, MICH.—W. W. Ewing advises us that he is at present engaged in restoring and extending the plant of the Grand Rapids Malleable Works, which was lately destroyed by fire. The plant is owned by the Chicago Railway Equipment Co., Great Northern Bldg., Chicago, Ill. Westinghouse, Church, Kerr & Co., 230 West 31st St., New York, are in the market for machinery and supplies for this work.

SUMMIT, ILL.—The directors of the Corn Products Refining Co., The Rookery, Chicago, have decided to construct the Western plant of the company at Summit, Ill. The necessary land for factories and mill, costing at least $5,000,000, with a capacity of 50,000 bushels of corn per day, has been secured. Contracts for construction work will be let at once and the erection of the first building will be begun in April. It is expected the entire plant will be completed and ready for operation Sept. 1, 1908. The site covers 110 acres at 63d St. and Archer Ave., in the Chicago district. Engineers and architects are now engaged on plans for 33 buildings. G. E. Chamberlain, 217 La Salle St., Chicago, is Arch.

DANVILLE, ILL.—The Chicago & Eastern Illinois R. R. Co. will duplicate its present shops at Danville. The Arnold Co., 181 La Salle St., Chicago, is the General Engr. Boilers, Corliss engine, air compressors, etc., will be required.

CRIVITZ, WIS.—A new company, to be called the New York-Wisconsin Cement Co., will erect the largest cement works in the United States at Rush Lake, Crivitz. The project includes an electrical line from Crivitz, and work will be started next spring.

KANSAS CITY, MO.—The Blue Seal Portland Cement Co., New York Life Bldg., is arranging for purchase of the necessary machinery and equipment for its proposed cement plant. L. H. Weber is Pres. of the company; J. H. Marshall is Treas. and Gen. Mgr., and J. W. Schroeder, Audr.

JOPLIN, MO.—A brewery, to cost $100,000, is to be erected here by St. Louis parties. It is being promoted by William Fehrenbeck, of Nacogdoches.

SEDALIA, MO.—Contracts probably will be let about March 1 for an addition to the plant of the Sedalia Woolen Mills Co., to cost about $15,000.

ST. LOUIS, MO.—The St. Louis Bed Mfg. Co. will erect a building, 554 × 101 ft., on McCasland Boulevard, between 24th and 25th Sts. Cost, $30,000.

ST. JOSEPH, MO.—We are informed that the St. Joseph Lead Co. is contemplating the erection of a cement brick factory, and will also develop the cement block industry.

BATESVILLE, ARK.—The erection of a canning factory, with a capacity of 10,000 cans daily, is contemplated.

BURDETTE, ARK.—The Three States Lumber Co., of Memphis, Tenn., is arranging to build a large planing mill and box factory at Burdette, where 100,000 ft. of cottonwood will be made into boxes daily. The Three States Co. is a heavy owner of cottonwood and gum timber in Arkansas, where most of its hardwood is manufactured.

HELENA, ARK.—Ford-Johnson Chair Co., of Frankfort, Ky., and Michigan City, Ind., has secured ten acres of land on which to locate factory. It is proposed to erect two main mill buildings, each two stories, 60 × 250 ft., together with the necessary dry-houses and warehouses. About $20,000 will be invested.

FORT WORTH, TEX.—The Fort Worth Glass & Sand Co. will operate glass factory having a capacity of 21 tons a day. A wood and corrugated iron building, with a floor space of 12,800 sq. ft., will be erected. Dave Wolverton, R. R. No. 5, Box 87, is Engr.-in-Charge.

READERS' WANTS

FOR THOSE IN THE MARKET The readers of ENGINEERING NEWS are constantly in the market for great quantities of machinery, tools and general supplies. While our thousand advertisers are usually able to furnish the material desired, yet there are many things wanted by our readers that are not advertised, although connected with engineering and contracting directly or indirectly. This department (R-W) is for this class of inquiries, and we urge our readers to keep us informed. Enclose five cents in stamps and we write to a number of leading manufacturers without further cost. When writing to our advertisers, who are the leaders in their respective lines, **mention Engineering News.** Have you a copy of our Buyers' Guide? **Engineering News Can Help Buyers.**

WOOD STIFF-LEG DERRICKS.—Shamokin, Pa.—The Roaring Creek Water Co., Shamokin, Pa., is in the market for a wood stiff-leg derrick.

STEEL RAILS.—Dallas, Tex.—The R. B. Godley Lumber Co., Dallas, Tex., informs us that it is in the market for new or relaying steel rails.

ROAD ROLLERS.—Indianapolis, Ind.—We are in receipt of a card from D. H. Fatout, 2006 W. Washington St., Indianapolis, Ind., stating that he is in the market for road rollers.

AIR LIFT PLANT, CEMENT, CONCRETE MIXERS, PILE DRIVERS, SHOVELS, WAGONS AND WELL-DRILLING MACHINERY.—Tacoma, Wash.—We are in receipt of a letter from George M. Savage, Tacoma, Wash., stating that he is in the market for an air lift plant, 30,000 barrels of cement, two concrete mixers, pile drivers, shovels, wagons and well-drilling machinery.

SPARK ARRESTOR.—New York, N. Y.—We are in receipt of a letter from E. S. Child, Arch., stating that he desires the names of firms manufacturing spark arrestors suitable for the top of a stack of a large hotel.

STUMP PULLER.—East St. Louis, Ill.—E. G. Helm, Consult. Engr., 230 Collinsville Ave., East St. Louis, Ill., desires to communicate with firms making small stump pullers to be used to pull hedge about 4 ins. in diameter.

CALCINING, GRINDING AND REFINING MACHINERY.—Newtonville, Mass.—We are informed that John J. Everson, Newtonville, Mass., is in the market for calcining, grinding and refining machinery.

PAPER BAG MACHINERY.—Mexico City, Mex.—We are in receipt of a letter from F. Lecomte, C. E., Apartado 2135, Mexico City, Mex., stating he desires machinery for making paper bags for plaster and cement.

GALVESTON, TEX.—Galveston Brewing Association is completing arrangements for improvements to ice plant, increasing the capacity from 125 tons to 225 tons daily. It is also proposed to improve power plant, installing a new light and power system and add a 350-HP. boiler. The various hoists, cranes, etc., now operated by steam or hand, will be operated by motors. An ice crusher, for preparing the ice for refrigerator cars, will connect with a chute enabling cars to be iced in 15 minutes. It is estimated that about $150,000 will be the cost of improvements.

FORT WORTH, TEX.—It is reported that a fence factory is to be erected here at a cost of $300,000. A. N. Evans is Secy. of Factory Club.

PORTLAND, ORE.—The Standard Box Co. has purchased the Haseltine dock, at the foot of East Oak St., for $65,000. The property has a river frontage of 200 ft., and is to be used by the new owners as an extension to their plant.

SPARKS, NEV.—It is stated that the Southern Pacific Co. will build a car factory in Sparks.

HILLSBOROUGH, N. B.—A company has been formed, with a capital of $50,000, for manufacturing hardwood flooring for export. Island Road, near the Salisbury & Harvey Ry., has been chosen for the site.

HALIFAX, N. S.—It is proposed to transfer the wood-working business of Silliker & Co., Ltd., now of Amherst, N. S., to Halifax and to establish an extensive plant for manufacture of railway box cars, flat cars, coal hoppers and baggage cars, with a capacity of 1,500 cars a year, and employing 250 men with an annual wage outlay of $150,000. The company is to be capitalized at $500,000.

TRURO, N. S.—Dominion Carriage Co. will install a $25,000 plant here. Among those interested are J. G. McMullen, John Stanfield, W. E. Bligh, of Truro, and Halifax parties. It is expected to supply the maritime provinces' demand for carriages.

TORONTO, ONT.—Thomas Ogilvie & Sons, of Aberdeen, Scotland, will erect a 5-story structure in Toronto for manufacture of woolen goods.

The Glen Milton Paper Mills have planned a large addition to their plant, to be of concrete, reinforced with steel girders. The foundation will require 700 bbls. cement and about 40,000 to 50,000 ft. of lumber will be required. A Montreal firm has the contract.

BELLEVILLE, ONT.—The Lehigh Portland Cement Co., Ltd., Belleville, Ont., head office Allentown, Pa., is receiving bids on all kinds of material, such as iron buildings, rotary kilns, rolls, tube mills, boilers, engines, stacks, dryers, etc. All enquiries should be made to the Allentown, Pa., office.

COBALT, ONT.—The North American Cobalt Refining Co. will erect a large smelter to treat all the ores in this vicinity. Approximate cost, $200,000; capacity, 500 tons daily.

PORT ARTHUR, ONT.—The Seaman-Kent Co., Meaford, Ont., will not commence work on their immense plant before spring, owing to the fact the stone foundation cannot be laid in frosty weather. A. G. Seaman, Meaford, Ont., is interested.

STRATHCONA, ALTA.—Bids are asked until Jan. 5 for the construction of a brew-house, stock-house, engine and boiler room for the Strathcona Brewing & Malting Co.

MISCELLANEOUS CONTRACTS.

The names of parties awarded contracts are printed in capital letters.

PAVILIONS.—New York, N. Y.—Bids are asked until 2.30 p. m., Jan. 2, for the erection and completion of two new isolation pavilions on Randall's Island. Robert W. Hebberd, Comr. Public Charities.

PILING.—Creston, Iowa.—Bids are asked until Jan. 9 by the Board County Supervisors for furnishing f. o. b. cars at any station in Union County, Oregon fir lumber and red cedar piling.

DRAINAGE DITCH.—Rosemond, Ill.—Bids are asked until Jan. 2 by J. W. Dappert, Engr., Taylorville, for constructing a three-mile 8-in. to 16-in. tile drainage ditch for the Highway Commissioners, near Rosemond.

SUBWAY.—West Point, N. Y.—Bids are asked until noon, Jan. 5, by the Quartermaster at West Point for constructing an electric subway system at West Point. Plans, specifications and bidding sheet are on file at the office of Engineering News, New York. (Advertised, Engineering News.)

CEMENT.—Detroit, Mich.—Bids are asked by the Department of Public Works until Jan. 10 for furnishing and delivering in cloth or paper sacks at a warehouse located on railroad at point between 12th and Reopelle Sts. and south of Michigan Ave., 15,000 bbls. of Portland cement. J. J. Haareer, Comr.

WATER-TUBE BOILERS.—New York, N. Y.—Bids are asked by Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until 10 a. m., Feb. 5, for furnishing at navy-yard, New York, six water-tube boilers for the U. S. Collier "Vestal." E. B. Rogers, Paymaster-Gen., U. S. N. (Advertised, Engineering News.)

WHARF.—New Orleans, La.—Bids are asked by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., until 11 a. m., Jan. 19, for strengthening old and constructing new wharves at the Naval Station. Mordecai T. Endicott, Ch. of Bureau. Specifications are on file at office of Engineering News, New York.

SURVEYING SEA MARSH.—New Orleans, La.—Bids are asked until Jan. 15 for surveying 50,000 acres of sea marsh land in the Burns Levee District, on the west bank of the Mississippi River, 50 miles below New Orleans, La. Address J. B. Fasterling, Pres., Buras, La., or John Dymond, Jr., 339 Cortland St., New Orleans, La.

LEVEE.—New Orleans, La.—Bids were received on Dec. 17 by Capt. J. F. McIndoe, Corps Engrs., U. S. A., for levee work in Lake Borgne Levee District. Bid of A. Leopold, Phoenix, La., was recommended for acceptance, as follows: Woodlawn levee, 44,000 cu. yds., at 22 cts. a cu. yd.; Fairview levee, 42,700 cu. yds., at 21 cts.

TELEPHONE SYSTEM.—Winnipeg, Man.—The electors of Manitoba have voted favorably on the proposition to build government long-distance lines, with municipal local exchanges. Work will be commenced as soon as the frost will permit of placing the poles. Francis Dagger is Provincial Telephone Expert, Government Buildings, Winnipeg, Man.

BREAKWATER.—Ottawa, Ont.—Bids are asked until Jan. 5 by Fred. Gelinas, Secy. Dept. of Public Works, for the construction of a breakwater at Phinney's Cove, Annapolis County, N. S., according to a plan and specification to be seen at the offices of C. E. W. Dodwell, Resident Engr., Halifax, N. S., and E. G. Millidge, Resident Engr., Antigonish, N. S.

TELEGRAPH POLES.—Montreal, Que.—Bids are asked by A. Bruce Smith, Supt. of Telegraphs, until Dec. 31 for delivery by May 1 f. o. b. 10,000 green cedar telegraph poles, or any portion thereof, consisting of 8,000 25-ft. poles and 2,000 30-ft. poles. Poles must be sound, straight, cut square at both ends, knots trimmed, bark peeled, 7 ins. diameter at small end.

STRAIGHTENING RIVER CHANNEL.—Utica, N. Y.—A conference was held last week at Utica between the city authorities and officials of the New York Central Railroad Company as to the plans for the straightening of the channel of the Mohawk River, in the town of Deerfield, Oneida County. This improvement is to be undertaken by a commission appointed by the Mayor of Utica, and the work is to include the straightening or changing of the course of the river and the construction of all necessary dikes, dams and other erections. The purpose of the improvement is to provide protection to the citizens of Utica from freshets, obstructions to sewers, etc. The maximum cost of the work is to be $150,000. R. W. Sherman is Mayor of Utica.

PROJECTILES.—Washington, D. C.—Bids were opened Dec. 19 at the Office of the Chief Clerk of Ordnance, Navy Department, Washington, D. C., for a quantity of projectiles for the navy. Bids were received from (a) Firth-Sterling Steel Co., Giesboro Point, D. C.; (b) American & British Mfg. Co., Bridgeport, Conn.; (c) Bethlehem Steel Co., South Bethlehem, Pa.; (d) Midvale Steel Co., Philadelphia. Delivery in each case states number of days before commencement, and number of shells delivered each week thereafter. The bids were: 1,000 6-in. armor-piercing shells. (a) $25 each, 200 days, 13 per week; (c) $32, 270 days, 27; (d) $37.50, 250 days. 1,000 7-in.: (a) $45, same time; (c) $62.50, 240 days, 15; (d) $64, 250 days. 1,000 8-in.: (a) $62.50, same time; (c) $91.50, 240 days, 15; (d) $100, 250 days. 1,000 12-in.: (a) $190, 200 days, 14; (c) $318, 300 days, 12; (d) $292, 250 days. 2,000 5-in. 60-pounder shells: (b) $6.62, 120 days, 220; (c) $9.90, 150 days, 100; (d) $11.25, 180 days. 5,000 6-in. target shells: (a) $10.45, 200 days, 30; (b) $11.95, 120 days, 200; (c) $18.50, 150 days, 85; (d) $23, 180 days. 1,000 7-in.: (a) $15.75, 200 days, 12; (b) $21.07, 120 days, 100; (c) $33, 120 days, 20; (d) $40, 150 days. 2,000 8-in.: (a) $20.90, 200 days, 32; (c) $52, 120 days, 20; (d) $48, 150 days. 1,000 12-in.: (a) $57.90, 200 days, 14; (c) $96, 120 days, 20; (d) $97, 180 days.

BARGE CANAL WORK.—Albany, N. Y.—The bids received by N. V. V. Franchot, Supt. of Public Works, on Dec. 19, for Barge Canal work, were as follows: On Contract No. 16, which is for furnishing and erecting in place various steel highway bridge superstructures, as follows. The McClintock-Marshall Construction Co., 13 Park Row, New York, $71,568; United Construction Co., 467 Broadway, Albany, N. Y., $63,473; Michael Fitzgerald, Hoosick Falls, N. Y., $66,734; Groton Bridge Co., Groton, N. Y., $67,491; The Lane Bridge Co., Painted Post, N. Y., $64,593; Penn Bridge Co., Beaver Falls, Pa., $67,270; Eastern Steel Co., 71 Broadway, New York, $67,293; Atlantic Gulf & Pacific Co., 13 Park Row, New York, $68,886. Engineer's estimate is $70,719.

On Contract No. 17, which is for the construction of the following structures on the Mohawk River: Dam 7, Lock 11, at Amsterdam, Sta. 2201 + 46; Dam 8, Lock 12, at Tribes Hill, Sta. 2443 + 17; and incidental work appertaining thereto. Length of canal included within the limits of these locks and their approaches, 0.4 mile: The Scofield Co., Pennsylvania Bldg., Philadelphia, Pa., $846,793; The John Pierce Co., 277 Broadway, New York, $971,943. The Engineer's estimate is $883,926.

On Contract No. 18, which is for excavating the canal and protecting its sides between Station 3868 + 26, about 0.5 mile east of Mindenville, and Sta. 4060, at Castle Creek; constructing Lock No. 16, with appertaining structures, abutments and approaches for two bridges, a dive culvert, guard gate masonry, a retaining dam for stream entrance at Castle Creek, a temporary canal at Mindenville, and other incidental work; Length of contract, 3.63 miles: The Kinser Construction Co., 1609 Railway Exchange, Chicago, Ill., $879,545; O'Brien & Hoolihan Contracting Co., Syracuse, N. Y., $859,460; Arthur W. Luce, 100 Broadway, New York, $935,415; The John Pierce Co., 277 Broadway, New York, $864,009. The Engineer's estimate is $785,980.

Contracts have been awarded as follows: Contract No. 16, to THE UNITED CONSTRUCTION CO., 467 Broadway, Albany, N. Y., for $63,473; Contract No. 18, to the O'BRIEN & HOOLIHAN CONTRACTING CO., of Syracuse, N. Y., for $859,460; and Contract No. 17, to THE SCOFIELD CO., of Philadelphia, Pa., upon reduction of its bid to $835,725. Full schedule of itemized prices on these contracts will be given under Contract Prices next week.

U. S. POSSESSIONS AND CUBA.

The names of parties awarded contracts are printed in capital letters.

CAST-IRON PIPE.—Panama.—The General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., has awarded to the CAMDEN IRON WORKS, Camden, N. J., contract for furnishing 25,860 ft. standard cast-iron pipe, various sizes, at $16,017; time 60 days.

WHARF WORK.—Alaska.—Bids are asked until 11 a. m., Jan. 11, by the Chief Quartermaster, Vancouver Barracks, Wash., for repairing a wharf at Fort Seward, Alaska. Plans and specifications may be seen at the office of the quartermaster at Seattle, Wash., and Fort Seward, Alaska.

BOILERS, ETC.—Panama.—Bids are asked until 10.30 a. m., Jan. 3, 1907, at the Office of D. W. Ross, Gen. Purchasing Officer of the Isthmian Canal Commission, Washington, D. C., under Circular 344, for four Scotch marine boilers; 60,000 lbs. track bolts; chucks; butts; 1,504,440 lbs. hay; 933,120 lbs. oats; 10,000 lbs. rock salt.

STEEL STANDPIPE.—Guantanamo, Cuba.—Bids were opened Dec. 19, at the Bureau of Equipment, Navy Dept., Washington, for the construction of a steel standpipe at the U. S. navy coal depot, Hospital Cay, Guantanamo, Cuba. Bids were: James B. Clow & Son, Chicago, Ill., $30,750; Chicago Bridge & Iron Works, Chicago, Ill., $28,500; H. E. Frick Co., Pittsburg, Pa., $28,356, including installation; W. W. Lindsey & Co. Philadelphai, $26,950, including installation; Snare & Triest, New York, $26,300. Prices do not include installation unless stated.

SUCTION DREDGES.—Panama.—The bids received Dec. 11 by the Isthmian Canal Commission, Washington, for two suction dredges have been rejected and new specifications have been issued, bids to be opened at 2:30 p. m. Jan. 12, under Circular 345. Bids are asked subject to the following deliveries: (a) one suction dredge, erected, completed and delivered at La Boca (Pacific Port), C. Z.; (b) same, at Cristobal (Atlantic Port), C. Z.; (c) same, at any Atlantic or Gulf port in the United States; (d) same, at any Pacific port in the United States; (e) —— suction dredges, knocked down and securely packed for ocean shipment, at any port in the United States. It is the intention of the Commission to purchase two dredges, one for each end of the Canal. Specifications and bidding sheets are on file at the office of Engineering News, New York.

WELL-DRILLS.—Panama.—David W. Ross, Gen. Purchasing Officer of the Isthmian Canal Commission, Washington, D. C., has awarded to the STAR DRILLING CO., Akron, Ohio, contract for furnishing 41 churn well-drills, engines, boilers and all appurtenances for the Isthmus, at $30,811. The remaining four drills of the requisition have not been awarded as yet. The bids received were as follows: For 45 churn well-drills and appurtenances. These are the drills for which bids were opened Dec. 6, but which were rejected and new specifications issued. American Well Works, Aurora, Ill., $631.50 each, with bids on separate items; f. o. b. Aurora, Ill., on bidder's specifications; Austin Mfg. Co., 315 Dearborn St., Chicago, $33,227.60; 55 to 90 days; Christman Co., 41 S. Erie St., Massillon, Ohio, $33,484.25; 60 to 150 days; Keystone Driller Co., Eighth Ave. and 20th St., Beaver Falls, Pa., $36,000; 60 to 140 days; Leidecker Tool Co., 119 Second St., Marietta, Ohio, $37,893.50; 30 to 140 days; Loomis Machine Co., 15 E. Market St., Tiffin, Ohio, $45,318.40; 18 to 180 days; Manning, Maxwell & Moore, Inc., 85 Liberty St., New York, $34,903; 70 to 120 days; Motley, Green & Co., 68 Broad St., New York, $43,770; 45 to 150 days; Star Drilling Machy. Co., Akron, Ohio, $32,831; 60 to 130 days.

MEXICO.

The names of parties awarded contracts are printed in capital letters.

FLOUR MILL.—Tampico, Tamaulipas.—A. G. Hudel, of the City of Monterey, Nuevo Leon, contemplates the erection of a flour mill in the City of Tampico.

PUBLIC BUILDINGS.—Veracruz, V. C.—The City Council of Veracruz has decided to construct a new prison, and to rebuild the city hall. The former is estimated to cost $250,000, and the latter $300,000.

BUILDING.—Monterey, Nuevo Leon.—A contract has been let to MAS BROS., Archs., city of Monterey, for the construction of a warehouse for the firm of J. Crom & Co. The amount of the contract is $45,000.

WATER-WORKS.—Zacatecas, Zac.—JOHN LEE STARK, who lately completed the water-works for the City of Morelia, has been awarded the contract for the construction of water-works at Zacatecas. The water will be secured from a series of artesian wells.

RAILWAY.—Guanajuato, Gto.—A belt line railway is projected to be built from the city of Guanajuato to its many mines, circling the district. From this railway, which will probably be standard gage, spur lines will be built to the various working properties.

WATER SUPPLY AND SEWERAGE.—Federal Dist.—Plans are being prepared for improving the sanitary condition of the towns of Coyoacan and San Pedro de los Pinos, in the federal dist. It is proposed to augment the water supply of the former and drain the latter. It is at present intended to secure the water supply from artesian wells.

GOLD PLACER DREDGES.—La Brisca, Sonora.—THE FULTON IRON WORKS, of San Francisco, have been awarded a contract for two dredges which are to be installed by the Greene Consolidated Gold Co. at its placers, in La Brisca, Sonora. The dredges will have a combined capacity of 2,000 cu. yds. of gravel per day, and will be in operation within eight months. The cost of construction and installation of the plant is stated will be $100,000.

STEEL WHARF.—San Benito, Chiapas.—THE MONTEREY STEEL CO. has been awarded the contract for the construction of a steel wharf at San Benito, a port on the Pacific coast of the State of Chiapas, near the Guatemalan frontier. The contract calls for, approximately, 2,000 tons of structural material. The amount of the contract is $514,000. Work will begin early in the year 1907, and must be completed not later than Dec. 31, 1908.

DRAINAGE AND IRRIGATION.—City of Mexico.—Gumesindo Enriquez, a lawyer, with offices in Calle de Corpus Christi, No. 7, has obtained a concession from the department of fomento authorizing him, or the company he may organize for the purpose, to drain Lake Lerma, in the state of Mexico, and to erect all the hydraulic works necessary for that purpose. Authority is given to make use of the waters of the lake for irrigation, and to take possession of the land reclaimed.

PACKING PLANT.—Monterey, Nuevo Leon.—A concession has been granted to L. H. Friesse, or to a company to be organized by him, for the establishment of a packing house in Monterey. The company will handle all classes of meats, and have a large refrigerator for the preservation of fish and oysters. Mr. Friesse is required to invest $200,000, and to have the plant in operation in two years from Nov. 9, the date of the concession. He has deposited with the state treasury the sum of $2,000 as a guarantee.

PUBLIC WORKS.—City of Mexico.—A bill asking for the following appropriations has been introduced in the federal congress: For construction of buildings and purchase of land for the primary schools of the federal district, in addition to the authorization already made, $1,500,000. Water-works for the City of Mexico, in addition to previous authorization, $2,500,000. Works on the ports of Coatzacoalcos and Salina Cruz, in addition to previous authorization, $20,000,000. These latter works are under contract by Pearson & Son.

SLAUGHTER HOUSE.—Chihuahua, Chih.—The official paper of the State of Chihuahua announces that the plans presented by C. Harter to the state government providing for the purchase of the site from the Chihuahua Mineral Ry. Co., which is about 7½ acres in extent, for the construction of a new slaughter house in the city of Chihuahua, have been approved, and a commission appointed to purchase the ground. Bids for the building are invited, limiting the expense to $40,000, with a surety of $5,000. One year is allowed for the completion of the work, with a forfeit of $50 for each day's delay.

SMELTER. — Guadalajara, Jalisco. — The Southern Pacific Ry. Co. has applied to the State Legislature of Jalisco for a concession for the establishment of a smelter in Guadalajara. The application is made by A. H. McKay, President of the Mercantile Banking Co., of the City of Mexico. Mr. McKay states that an initial investment of not less than $200,000 will be made, and that the initial capacity of the smelter will be at least 100 tons daily, to be increased as the demands on the plant warrant. Epes Randolph, Pres. of the Federal Engineering & Construction Co., San Juan de Letran, No. 3, City of Mexico, represents the Southern Pacific Ry. Co. in Mexico.

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INDUSTRIAL NOTES.

M. T. DAVIDSON informs us that his office will be in the Tribune Bldg., 154 Nassau St., New York, after Jan. 1.

THE FRANKLIN ENGINEERING CO., with offices at 600 Columbus Savings & Trust Bldg., Columbus, O., has been organized to do a general consulting engineering business.

THE SULLIVAN MACHINERY CO., of Chicago, manufacturing air compressors and rock drills, etc., announces that it has opened a branch office at 319 Howard St., San Francisco, in charge of Mr. Howard T. Walsh.

THE ELECTRIC CABLE COMPANY, of 17 Battery Place, New York, has recently sold to the Westinghouse, Church, Kerr & Co. a large amount of Voltax cables, to be installed on the New York, New Haven & Hartford Railroad Co.'s plant at Cos Cob, Conn.

THE AMERICAN TRACING CLOTH CO., 11 Broadway, New York City, has established the manufacture of tracing cloth in the United States, havnig completed a plant at Paterson, N. J. It is claimed that the quality o fthe product is equal to that of the imported cloths.

JOHN F. ALLEN, 370 and 372 Gerard Ave., New York, reports an order from the American Car & Foundry Company for six Allen compression lever riveters, to be used in its new plant in St. Louis, Mo. This is part of an equipment of fifteen riveters for the same plant, the balance of which will be ready for shipment by the first of January.

THE ATLAS ENGINE WORKS have just closed an extraordinary year, claiming to have increased their sales 85% and shipments 90%, and it is their proud claim that they have so taken care of the remarkable increase in business as not to have had at the end of their fiscal year one single past-due order on their books.

THE H. W. JOHNS-MANVILLE CO. has found it necessary, in order to handle to the best advantage their large and rapidly increasing business in this section, to open a New Orleans branch on Jan. 1. This will consist of a large retail store, offices and warerooms, located in the large 3-story building at the corner of Baronne and Perdido Sts.

THE STEEL PROTECTED CONCRETE CO. reports that the Pennsylvania Railroad Co. has adopted the Wainwright Steel-Bound Concrete Curb at its new stations at West Philadelphia, North Philadelphia, Camden, Dover and Seaford. The following railroad companies are also using it in connection with their station improvements: Philadelphia & Reading R. R., New York Central & Hudson River R. R., Boston & Maine R. R., Long Island R. R., and the Southern Ry.

THE COFFIN VALVE COMPANY of Boston, has recently contracted with the Charles River Basin Commission for twenty-eight sluice gates to be used in connection with the new Charles River Dam and Lock. Twenty-five of these sluice gates are to be electrically operated, having special controlling mechanism of the latest and most up-to-date type. Nearly all of the sluice gates are to be controlled from a central tower several hundred feet from their loxcation.

THE POWER AND MINING MACHINERY COMPANY, of Cudahy, Wis., in conjunction with the SNOW STEAM PUMP WORKS, of Buffalo, N. Y., has opened a new sales office at 719 White Bldg., Buffalo, where will be handled the several types of gas-generating apparatus, such as the Loomis-Pettibone system, suction and pressure gas plants, built by the Power and Mining Machinery Company, and the Snow gas engines, built by the Snow Steam Pump Works. Mr. Seward Babbitt, the Sales Manager, will make his headquarters at the Buffalo office, on account of the facility for conducting business from that point.

THE NUBIAN PAINT & VARNISH CO., of Chicago, is introducing a protective paint for use on both steel and concrete in which the base is elaterite, obtained in Utah. A special feature is that the elaterite contains considerably more ichthyol than is present in asphaltum bases, and is of a more oily character. The sulphur is eliminated and the base boiled with Chinese wood-oil, the effect of which is to make it very smooth, so that it can be readily spread to cover a large area, although quite thick. The paint is not sticky or tacky, and by the use of this oil it retains its normal consistency even at very low temperatures. It is claimed that a thin film of this paint is proof against acids and acid vapors. The paint has already been used for the 11-ft. Torresdale steel conduit at Philadelphia, the Interstate Viaduct at Kansas City, and steel bridges on the Kansas City Southern Ry. It has also been used for coating wood-stave pipe, and for waterproofing concrete work. Apart from its use as a paint, it is also said to make an excellent insulating compound.

THE BUFFALO FORGE CO., Buffalo, N. Y., has closed a contract with the Illinois Steel Co. to furnish two centrifugal water spray gas cleansing fans with cast-iron housings, which will weigh approximately 4,100 lbs. each, to be used in the plant at Bay View, Wis. (a suburb of Milwaukee). The following may be mentioned as recent contracts also awarded to this firm: Electric Motor & Equipment Co., Newark, N. J., one equipment with 100-in. fan for Franklin School; one equipment with 100-in. fan for Avon Ave. School. Roth & Englehardt, St. Johnsville, New York: one equipment with special fan and five sections heater. Kupferle Bros. Mfg. Co., St. Louis, Mo.: one equipment, including 90-in. pulley fan, complete, Buffalo air washer and humidifier installation of 32 sq. ft. air washer, settling tank and direct-connected 1½-in. centrifugal pump driven by a 2-HP. motor for furnishing water under pressure to the spray nozzles. This will be installed in Liederkranz Hall, St. Louis, Mo. New York Steam Fitting Co., New York City: one equipment, including 90-in. direct-connected electric fan, with heater, etc.

For other Proposal Advertisements see pages 51, 52, 53, 54, of Advertisements and Construction News page 224.

SEWER.

Burlington, Iowa.

Sealed proposals will be received at the office of the City Clerk until 4 o'clock p. m., Monday, March 18th, 1907, and opened at the first regular or adjourned council meeting thereafter, for construction of a vitrified pipe sewer known as the Locust Street sewer and branches, in accordance with plans and specifications on file in the City Engineer's office.

Each proposal must be accompanied in a separate envelope by a certified check in the sum of $4,000, made payable to the order of the City Treasurer.

A bond in the sum of $10,000, with two or more resident sureties, or with a surety company, as surety, will be required for the faithful performance of the contract. Sureties must be satisfactory to the city council. In case a contract is awarded the work shall be commenced on or about the 5th day of April, 1907, and completed on or before the 1st day of November, 1907.

The city council reserves the right to reject any and all bids or to accept the proposal deemed by them to be for the best interests of the city.

J. F. WINTERS,
26-1t City Engineer.

TOWER CLOCK.

Brunswick, Ga.

Sealed proposals are hereby invited by the Commissioners of Glynn County, Georgia, for installing a tower clock in county court-house. Bids must be filed with Clerk of the Commissioners by January 2, 1907. Full information can be had on application to Charles A. Gifford and Edward S. Betts, Associate Architects, 18 East 17th Street, New York City, or to the Clerk of County Commissioners.

J. J. LOTT, Chairman,
A. O. TOWNSEND, Clerk,
26-1t

GRADING.

Have good piece railroad grading work to sublet, requiring Traction Shovel or Scraper Plants; about 12 miles from railroad in Charlotte County, Virginia, on Tidewater Railway. Address

McDERMOTT CONTRACTING COMPANY,
1116 Pennsylvania Building, Philadelphia.
26-1t

WATER SUPPLY.

Buena Vista, Ga.

City of Buena Vista, Ga., wants proposals for best method developing water supply. Well 245 feet deep. Water one hundred feet in well.

S. N. RUSHIN,
26-1t Mayor.

PROPOSALS will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 o'clock a. m., Feb. 5, 1907, and publicly opened immediately thereafter, to furnish at the navy yard, New York, N. Y., 6 water-tube boilers for the U. S. collier "Vestal." Applications for proposals should refer to Schedule 328. Blank proposals will be furnished upon application to the navy pay office, New York, N. Y., or to the Bureau. E. B. ROGERS, Paymaster-General, U. S. N.
26-2t

OFFICE COMMISSIONERS D. C., Washington, D. C., December 21, 1906.—Sealed proposals will be received at this office until 12 M., Saturday, January 5, 1907, for improvement of Street Cleaning Department Stable, located in alley between N and O and 9th and 10th streets, N. W. Plans, specifications and all necessa nformation may be obtained at this off Proposals to be accompanied by certi check for $100, to be deposited with Collector of Taxes, D. C., to the credit the Commissioners, D. C., to guarant at the bidder will enter upon the contr f awarded, within the stipulated time; an urther, the work must be done in such manner to allow for the occupancy of on alf of the stable during the progress o the work. HENRY B. F. MACFARLAND HENRY L. WEST, JOHN BIDDLE, C missioners, D. C.
26-1t

EXTENSION OF TIME OF OP ING BIDS FOR SCHERZER ROLLING L T STEEL HIGHWAY DRAWBR E.

Camb e, Mass.

The time for receiving bids f the Scherzer Rolling Lift Drawbridge oss Lechmere Canal, in the line of Co rcial Avenue, Cambridge, Mass., adver in issue of this journal Dec. 20, 1906, JANUARY 2D, 1907, IS HEREBY EXTE ED TO 12 O'CLOCK NOON OF WEDNE Y, JANUARY 16TH, 1907. All other ditions to remain the same. L. M. TINGS,
26-1t C Engineer.
Cambridge, Mass., December 1906.

SITUATIONS PEN

POSITION SHORTLY OPEN high-grade salesman familiar with he transmission and conveyor work, to ndle well-established line of canvas ng. Apply, stating age, experienc esent employment, references, salar and send photo. Address "C. A. 26," gineering News, New York.
26-1t

FOR SALE

Vu'can Contractors' Saddie Tank

for sale. Cyls. 7 x 12, 8-tons, gauge. Built June, 1906. Located at N. Y. City, delivery early January.

CHARLES F. AVERY,
26-2t 45 Broadway, N. Y.

Contractors' Plant For Sale

Apply to David L. Emanuel, Catasauqua, Pa., or Wm. M. Morrison, 330 Drexel Bldg., Philadelphia, Pa.

2 Kingsford Machine Co.'s Direct Connected 6" Centrifugal Pumps.
2 OS 7 × 10 DD-DS Hoisting Engines, without Boilers.
4 Derrick Casting and Fitting outfits, including guy lines for three 50' Derrick.
2 O-D Rand Steam Drills, complete, with steels.
12 No. 3 Rand Steam Drills, complete.
1 125-HP. Pennsylvania Boiler Works Locomotive Boiler.
1 125-HP. Centre Crank Nagle Engine.
2 Diaphragm Pumps.
1 No. 3 Style D Gates Crusher.
1 No. 7½ Austin Crusher.
1 16' × 48" Revolving Screen.
1 ½ Yard Smith Mixer with Engine and without Boiler.
1 6-Wheel 40-ton Mogul Locomotive.
4 80,000-pound capacity centre dump Rodgers Ballast Cars.
1 Plow Car.
1 25-ton Vulcan Traction Steam Shovel.
26-1t

SPECIAL—Immediate Delivery. Right Out of Our Works

Flat and Gondola Cars

60,000 capacity. 36 feet 10 inches long. Westinghouse Air, etc.

A. C. TORBERT & COMPANY

Telegraph, Telephone or Write us.

GENERAL OFFICES, MONADNOCK BUILDING, CHICAGO, ILL.

Locomotives, Cars, Steam Shovels, etc.